

## MM 1.3 : Genetic improvement through introgression of useful genes in cultivated species of cotton

Principal Investigator : B.M. Khadi, UAS, Dharwad

### Target & Achievement

Target/activity	Achievement
1. Identification of wild and cultivated sources for superior fiber properties, biotic and abiotic stresses	<p><b>Bollworm complex:</b> AKA01-1, 01-2, 01-4, 01-5, IGM -28, 42, 99, MSP-345, TCH-1648, 1653, LD327, AKDH 33, RAC 023, AKA 0311, AKH 2053, 0303, 0305, Hh-1, 2, 3, IS376/4/1, GISV 203 &amp; GISV 206 found promising for bollworm. <i>G. raimandii</i> and <i>G. Bickii</i> are resistant to bollworm.</p> <p><b>Sucking pest tolerant:</b> TCH 1648, 1649, 1652, 1653, MSH-345, MSH-SP-91, 53, AKA-01-1, 01-4, GISV 33, 105, 175, 23,142, 175, Rai 7B-1, 7B-2 &amp; IS-376/4/1/34/1 found promising for sucking pest. <i>G. anomalum</i> and <i>G. davidsonii</i> are resistant to jassid and aphids.</p> <p><b>CLCuV tolerant:</b> TCH-1649, 1648, 1652, 1693, 1695, AKH 8828, AKA 01-1 to 9, IGM 27, 100, 105, Rai 7B-1, Rai-4A-2, MSHSP-91, Gcot-10 x GISV 61-B, Abhadita x TCH 2 &amp; Gcot-16 x GISV 162 found promising for CLCV.</p> <p><b>Promising for BLB:</b> AH 31-5, AH32-3, AH-36-1, Hh-2, Hh-7, TCH-1647, 1648, 1649, AKA 01-5, GISV-23 &amp; 33 <i>G. aridum</i> and <i>G. taitense</i> are tolerant to drought, <i>G. davidsonii</i> tolerant to salinity, <i>G. anomalum</i>, <i>G. australe</i> &amp; <i>G. raimandii</i> are tolerant to stress.</p> <p><b>Promising for Yield:</b> AH10-3, AH-32-3, AH-31-5, Hh 7, IGM 102, GISV61 (1675kg/ha), TCH 1691 (1691kg/ha), MCU13, GISV 218 (2986 kg/ha), JAB 2-5,1-5, JAB2-4, JAB-2-6, MCU-5, 9, 12, KH-3-3, AKA-8, RAC 29, 32, 35, IS 376/4/1/23 found promising for seed cotton yield.</p> <p><b>GOT (%):</b> RAX 16 (39.5%), GISV-61 (38.7%), RAC 023 (39.5%), GISV 218 (39.3%), GISV 185 (39.6%), TCH 1693 (35%), TCH 1696 (36%), AKH 8828 (35.5%), KWIS 4 (37.7%), AKA 5 (38.8%) found promising for GOT</p> <p><b>2.5% Span length:</b> RH1-6 (28.7mm), RH1-4 (28.4mm), TCH 1648 (30.5mm), TCH 1649 (30.0mm), IS 30/68 (29.8mm), KWIS 28/KH22-5 (33.1mm), KWIS-19 (32.1mm).</p> <p><b>Bundle strength :</b>TCH 1649 (25.1 g/t), TCH 1653 (26.1 g/t), GISV 206 (26.2g/t), KWIS 28 (26g/t), KWIS-7 (27.5g/t).</p>
2. Overcoming incompatibility barriers in interspecific hybridization of wild & cultivated species.	<p>Growth response and enlargement of ovules were mainly related to callusing, enlargement of ovules occasionally lead to regeneration up to cotyledonary stage. Obtained distant hybrids between <i>G. hirsutum</i> x <i>G. sturtianum</i>, <i>G. hirsutum</i> x <i>G. aridum</i>, <i>G. hirsutum</i> x <i>G. raimondii</i>, <i>G. hirsutum</i> x <i>G. klotzschianum</i>, <i>G. hirsutum</i> x <i>G. longicalyx</i>, <i>G. hirsutum</i> x <i>G. davidsonii</i>. Successfully doubled the chromosomes of <i>G. arboreum</i> var. G-27 and <i>G. herbaceum</i> var. GBHV-189.</p> <p>In backcrosses involving triploid as male parent with tetraploid <i>hirsutum</i> parents seed set was noticed in MCU5 x (MCU5 x <i>G. armourianum</i>) &amp; MCU12 x (MCU12 x <i>G. triphyllum</i>).</p>
3. Introgression breeding for the improvement of tetraploid & diploid genotypes through conventional & non	<p><b>Ginning Out Turn (%):</b> Single plants with higher GOT have selected from the segregating generation of Abhadita x TCH P2, GISV 197 x GISV 61, G cot 10 x GISV 16, G. Cot 16 x GISV 162, Abhadita x AKH-2031, Abhadita x Surat-2.</p> <p><b>Better fibre properties:</b> Genotypes having superior fibre properties</p>

<p>conventional approaches for-</p> <p>a) better fibre properties,</p> <p>b) Gossypol free oil</p> <p>c) Biotic stress resistance like jassid, whitefly, bollworm, alternaria, BLB, grey mildew &amp; CLCV</p> <p>d) Abiotic stress resistance like drought &amp; water logging</p> <p>e) Male sterility</p>	<p>(SL&gt;30mm and strength &gt; 23g/t) were selected from the crosses G.cot 20 x GISV 61, G. cot 10 x GISV 79, G.cot 16 x GISV 61, Abhadita x TCH-6, Abhdita x TCH-2, G.cot 11 x AH 32-3, Abhadita x IV-2, DC 59 x Morilii, DC 57 x GM, LRA 5166 x IGM 42, Abhadita x Rai, Abadita x TCH-3, VHF x TCH 1653, JGM 100 x IGM 4.</p> <p><b>Sucking pest tolerant:</b> Genotypes tolerant to sucking pests were selected from the crosses LRA 5166 x IGM 42, Gcot 10 x GISV 61, G cot 11 x AH32-3, Abhadita x MSHSP 53, Abhadita x TCH-1, G.cot 16 x GISV 61, Sarvottam x KWA-7.</p> <p><b>Bollworm tolerant:</b> Genotypes tolerant to bollworm were selected from the crosses (Ponduru x ARB-F-28) x Jayadhar tapti, Rai-3, Digvijay x Hh-2, LRA-5166 x IGM 42, Abhadita x TCH2, Abhadita x TCH-3.</p> <p><b>Disease tolerant:</b> Genotypes tolerant to CLCV selected from the crosses Abhadita x TCH-2, Abhadita x Rai, Abhadita x AKH 5053, Abhadita x TCH -1, Abhadita x TCH-3, G.cot 10 x GISV 61, G cot 16 x GISV 162. Genotypes tolerant to Bacterial blight selected from the crosses. Abhadita x IV2, Abhadita x TCH-3.</p> <p><b>Restorer lines:</b> R lines developed based on <i>G. harkensii</i> cytoplasm are R-42-8, R-41-10 &amp; RPK-8 &amp; based on <i>G. aridum</i> are 1060/1,2,3,4,5,6: 1044/1,2,3,4,6,7,8,9,10 &amp; 1044/23-1.</p>						
<p>4. Evaluation of introgressed genetic material for the trait in question &amp; utilization of sources in transferring to the superior agronomic base genotypes.</p>	<p><b>Promising for yield:</b> GISV 206, GISV-185, GISV-33, GISV-2, GISV-203 x GISV-178, G.cot 23 x AH 32-3, GISV-201 x TCH-1653, ACT-SP-8-1, ACT-SP-5-2. ICGH-475. RAC-023 (18.6 q/ha &amp; 41.9% GOT), Jab 79 (24.5 q/ha).</p> <p><b>GOT %:</b> RAC-024, GISV-201, G.cot 17 x AKA-01-4 (40.1%), GISV-201 x NH-194 (39.4%). ACT-SP-16-1 (42%), ICGH-379, ICB-5 (38.9%).</p> <p><b>Fibre properties:</b> TCH-1648, TCH-1654, TCH-1691, TCH-1692, TCH-1695, TCH-1696, G.cot 23 x AKA-01-9, G.cot 17 x AKA-01-3, GISV-61 x GSB-10, GISV-61 x GSB1, GISV-61 x GSB6, GISV61 x TCH-1648, ICB 220(35.2mm), ICB 185, LK-861 x TCH-1623 (33.43 mm), LK-861 x BS-33 (27.5 g/t), ICB 110 (29.8 g/t).</p> <p><b>Bollworm tolerant:</b> CNH-911 x Rai 4A-2, RS-810 x Rai 11-3.</p> <p><b>Sucking pest &amp; CLCV tolerant:</b> CNH-911 x TCH-1652, F-505 x TCH-1653, RS-810 x Rai 11-3.</p> <p><b>Root rot tolerant:</b> GISV-33, GISV-206 and GISV-214 are promising for root rot.</p> <p><b>Drought tolerant:</b> GISV-33, GISV-206, GISV-105, GISV-240, GISV-216 are promising for drought.</p> <p><b>Salinity:</b> GISV-214 promising for salinity</p> <p><b>Introgressed genotypes contributed to AICCIP trials</b></p> <table border="1" data-bbox="630 1499 1458 1692"> <thead> <tr> <th>Year</th> <th>Genotypes</th> </tr> </thead> <tbody> <tr> <td>2004-05</td> <td>CCH 317 (Br-02a), L 789 (Br 02a), NDL 764 (Br 02b), Las 6 (Br 22), NDLHH16 (Br 05b-1PHT)</td> </tr> <tr> <td>2005-06</td> <td>DDHC 1002 (Br 34b IET), ANGHC 1003 (Br 34b IET) &amp; ANGHC 1004 (Br 34b IET)</td> </tr> </tbody> </table>	Year	Genotypes	2004-05	CCH 317 (Br-02a), L 789 (Br 02a), NDL 764 (Br 02b), Las 6 (Br 22), NDLHH16 (Br 05b-1PHT)	2005-06	DDHC 1002 (Br 34b IET), ANGHC 1003 (Br 34b IET) & ANGHC 1004 (Br 34b IET)
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### **Progress of Work:**

**Identification of wild and cultivated sources for superior fibre properties, biotic and abiotic stresses**

❖ **Identification of sources of resistance against biotic and abiotic stresses and fiber properties**

### **South Zone :**

#### **TNAU, Coimbatore :**

**Experiment I:** A total of thirty cultures tested, the culture TCH 1691 and check MCU 13 recorded highest seed cotton yield of 1455 Kg /ha followed by AKH 0312 (1432Kg/ha). The culture IS 30/68 recorded a highest span length of 29.8 mm followed by TCH 1695 (29.3 mm). Three cultures viz., AKH 0306, GISV 206 and GISV 240 recorded strength / length ratio of 0.8 and above .

**Experiment II:** In this trial, among the cultures tested RAC 032 registered the highest seed cotton yield of 1407 kg/ha followed by MSH 45 (1155 Kg/ha). The culture MSH 45 recorded a highest span length of 25.4 mm and strength of 21.1 g/tex with a strength / length ratio of 0.83. A total of four cultures recorded a strength / length ratio of 0.8 and above.

### **Central Zone:**

#### **OUAT, Bhawanipatna:**

**Exploration and collection of wild germplasm from interior pockets.**

Scientists visited the interior pockets of Nabarangpur, Phulbani, Rayagada and Gajapati districts at different stages and collected the cuttings and seeds of wild germplasm. These will be utilized for future breeding programme for disease resistance and bollworm tolerance. Eight wild species materials were collected from Phulbani district of Orissa and were planted in the field. But only two of the entries survived and are yet to be identified.

#### **CRS, Nanded:**

**Evaluation of introgressed genotypes developed at C.R.S. Nanded showing resistance to sucking pest.**

The culture IS-376/4/1/34/1 recorded the highest yield (819 kg/ha), which was significantly superior over hirsutum checks, NH-545 (444 kg/ ha) and NHH-44 (361 kg/ha) Table 5. Three cultures namely IS376/4/1/30/68/1, (NH-111/1 x IS-376/4/3) x IS- 376/4/3 and IS-376/4/1/68/2 were found superior for G.O.T.

(above 37.8%). The culture IS376/4/1/2/29 has good combination of yield (528 kg/ha) and staple length (26.2 mm). The culture IS 376/4/3 depicted superior staple length (26.3mm) and fibre strength (20.5 g/tex) .

**Evaluation of introgressed genotypes developed at C.R.S. Nanded showing drought tolerance.**

The cultures showing hard woody stem, stay greenness habit, robust plant growth and having rejuvenation capacity were identified as drought tolerant cultures. Cultures IS-376/4/1/1/80 recorded significantly higher yield (639 kg/ha), over hirsutum checks, namely NH-545 (403 kg/ ha). The cultures IS-376/4/1/23/74 and IS-376/4/1/3/6 were found to possess good combination of yield and staple length (above 26.0mm).

❖ **Screening and evaluation of interspecific derivatives, germplasm lines and other breeding materials for biotic, abiotic stresses and fibre quality.**

**SOUTH ZONE:**

**UAS., Dharwad:**

Nine H x H hybrids developed through introgression breeding at CICR Sirsa were evaluated in RBD with two replications. None of the test hybrids is numerically superior over local check DHH 11 for seed cotton yield and boll weight. However, among the test hybrids VHF x TCH 1652 produced maximum seed cotton yield (501 kg/ha) followed by BF x TCH 1652 (498 kg/ha) and BM x TCH 1648 (493 kg/ha). The maximum boll weight was observed in VHM x TCH 1648 (3.7g) and DHH 11 (LC) (3.7g) hybrids. The hybrids VHM x TCH 1652 (39.2%) and B x TCH 1653 (38.8%) had numerically superior GOT than local check DHH-11 (38.6%).

The maximum staple length was observed in BM x TCH 1648 (28.1 mm) hybrid followed by VHF x IN-35 (27.5 mm) and BF x TCH 1652 (27.4 g/t, Table 7a). The maximum fibre strength was observed in BF x TCH 1652 (23.3 g/t) followed by VHF x TCH 1648 (22.3 g/t), VHM x TCH 1648 (22.2 g/t) and VHF x IN 35 (22.0g/t). The hybrids BF x TCH 1652, BM x TCH 1648 and VHF x IN 35 had higher fibre length and strength than local check DHH 11. The F<sub>2</sub> segregating generation of these crosses will be screened for isolation of genotypes with good fibre length and strength.

### **Central Zone:**

#### **CRS, Surat:**

The trial was conducted at different locations with different objectives. The trials failed at CSSRI (Samani) and Danti due to continuous and heavy rain during the season.

**Surat :** The trial was laid to evaluate yield potentiality, fibre quality and resistance to biotic stress. The differences in seed cotton yield were significant. None of the genotypes was significantly superior to check G.Cot-16 (1171 Kg/ha). Numerically, the genotype GISV-240 recorded maximum seed cotton yield (1547 Kg/ha) followed by GISV-218 (1489 Kg/ha). The top yielding genotype also recorded maximum lint yield (586 Kg/ha). The GOT values of these entries ranged from 32.7 (GISV-2) to 39.3%(GISV-218). The maximum boll weight was recorded in GISV-185 (4.03 g).

In respect of fibre quality, these entries were medium to long in staple length (24.4 to 27.6mm) with coarse to average in fibre fineness (5.7 to 4.0mv), good in maturity (0.83 to 0.86), average to good tenacity (20.1 to 23.9 g/tex) and good to excellent uniformity (45 to 52%). The individual plants were selected on the basis of yield potentiality and resistance against biotic stress at Surat for further evaluation in next season.

Out of 14 entries, all the entries were found tolerant to aphids and whitefly. Entries viz., GISV-33, GISV-61, GISV-203 and GISV-216 had recorded high population of jassids. Rest of the entries recorded lower population of jassids and found tolerant to jassids. In case of thrips, all the entries recorded population below ETL and were found tolerant, except entries viz., GISV-2, GISV-61, GISV-105, GISV-216 and GISV-218 had recorded higher population of thrips. In case of bollworm damage, most of the entries recorded less than 5% damage to square and green bolls except entries viz., GISV-2, GISV-61, GISV-105, GISV-185 and GISV-203. On the other hand, all the entries recorded very high incidence of bollworm to open bolls and locules except entries viz., GISV-33 and G.Cot-16 had recorded less damage. None of the entries were resistant to bacterial blight.

**Bharuch :** The trial laid out at Bharuch in rainfed condition, with an objective to isolate genotypes tolerant to drought and resistance against biotic stress. ANOVA revealed that varietal differences in seed cotton yield were not significant. Numerically, GISV-105 (1701 Kg/ha) recorded maximum seed cotton yield followed

by GISV-240 (1577 Kg/ha). The GOT values of these genotypes ranged from 33.5 (GISV-33) to 39.6% (GISV-185). The maximum boll weight was recorded by GISV-185 (4.0g). The genotypes GISV-2, GISV-203 and GISV-218 were found susceptible to sucking pests, whereas GISV-105 and G.Cot-16 were found tolerant to drought situation.

**Achhalia :** The trial was conducted with an objective to isolate the genotypes with resistance against grey mildew disease and fibre quality. The ANOVA revealed significant varietal differences for seed cotton yield. Only one genotype GISV-216 (2479 Kg/ha) was significantly superior over check G.Cot-16 (2023 Kg/ha) followed by GISV-214 (2192 Kg/ha) and GISV-240 (2119 Kg/ha). The GOT values of these genotypes ranged from 32.6(GISV-2) to 38.9% (GISV-218). The infection of grey mildew disease was not observed during the season.

With respect to fibre properties, these genotypes were medium to long in staple length (23.1 to 28.0mm) with average to fine in fineness (4.9 to 3.5mv), average to good in maturity (0.80 to 0.84), low to average in tenacity (16.7 to 22.0 g/tex) and excellent uniformity (47 to 51 %).

**Thasra :** The trial was laid out with an objective to isolate the genotypes with resistance against root rot and fibre quality. The ANOVA revealed highly significant varietal differences for seed cotton yield. Four genotypes Viz., GISV-218 (2986 Kg/ha), GISV-33 (2419 Kg/ha), GISV-206 (2233 kg/ha) and GISV-216 (2203 Kg/ha) significantly superior over check G.Cot-16 (1898 Kg/ha) followed by GISV-105 (2087 Kg/ha). The top yielding genotype maintained its superiority in lint yield (1173 Kg/ha) also. The GOT values of these genotypes ranged from 30.9 (GISV-2) to 39.3% (GISV-218). With respect to fibre properties, these genotypes were medium to long staple (23.9 to 30.1mm) with coarse to fine fibre (5.5 to 3.6 mv), average maturity (0.79 to 0.85), low to average tenacity (16.8 to 22.5 g/tex) and excellent uniformity (47 to 53%). The genotype GISV-105, GISV-197, GISV-216 and GISV-2, GISV-203, GISV-238, GISV-240 were found disease free and resistant against root rot respectively.

**Porbander:** Porbandar is situated in coastal part of Saurashtra with an average annual rainfall of about 120 to 250 mm. Testing of different promising genotypes under such situation was carried under drought condition. ANOVA revealed non-significant varietal differences for seed cotton yield. Numerically, maximum seed

cotton yield was recorded in GISV-216 (764 Kg/ha) followed by GISV-33 (683 Kg/ha). The GOT of these genotypes ranged from 33.4 (GISV-2) to 43.2 % (GISV-218). The maximum boll weight and number of bolls per plant was recorded by GISV-185 (3.1g) and GISV-105 (26.4), respectively. The GISV-216 found tolerant to drought.

From the overall performance, GISV-218 and GISV-216 appeared promising for seed cotton yield and GISV-185 for higher boll weight.

**JNKVV, Khandwa :**

**Evaluation of the cultures derived from introgressed material**

The data on the seed cotton yield indicate that KH 3-3 was the highest yielder closely followed by KWIS 34. The data also indicate that KWIS 4 gave the highest ginning percentage closely followed by KWIS 60. It is interesting to note that two entries viz. KWIS 60 and KWIS 25 (G) gave very good seed cotton yield and have a high ginning percentage.

**Bollworm resistance:** All the entries were scored for bollworm damage in terms of square damage, and boll damage. The data on square damage (%) and boll damage (%) indicate that considering both the parameters all the entries exhibited lower bollworm damage. The performance of KWIS 26 (G) was best in respect of its resistance to bollworm complex.

**Resistance for Myrothecium Leaf spot and Bacterial blight:** All the 28 entries were scored for their reaction towards two diseases viz. MLS and BLB. The reaction has been recorded on a 0-4 scale with reactions 0, 1 and 2 depicting resistance/tolerance.

Entries were resistant to bacterial leaf blight. None of the entries tested was found to be resistant for Myrothecium leaf spot. These entries need to be tested for at least one more season to confirm their reaction with adequate selection pressure.

**Fibre quality:** The data of promising entries are presented in the table 1.3.1.

**Table 1.3.1 :**

Sl No	Entry	2.5% SL (mm)	Strength (g/Tex)	Sl No	Entry	2.5% SL (mm)	Strength (g/Tex)
1	KWIS-6	30.1	23.5	6	KWIS-23	30.8	25.4
2	KWIS-7	30.8	27.5	7	KWIS-28	29.7	26.3
3	KWIS-89	30.0	24.7	8	KWIS-30	30.4	23.6
4	KWIS-9	29.1	25.0	9	KWIS-36	29.2	23.9
5	KWIS-3	30.9	26.3	10	KWIS-2	29.6	-
				11	KWIS-19	32.1	-

**North Zone:**

**RAU, Sriganaganagar :** To broaden the genetic base of resistance against CLCV disease, introgressed material received from Nanded was crossed with our resistant varieties RS 2013 and RS 875 during 2002-03. Twenty-three progenies of F<sub>2</sub> populations of these crosses were evaluated for agronomic traits, biotic stress and quality parameters.

**Agronomic Traits :** In this trial 23 F<sub>2</sub> populations (cross between Nanded material with RS 2013 and RS 875) were evaluated in non-replicated trials for agronomical traits and stresses against biotic stress. The F<sub>2</sub>#10 (IS-376/4/2-15 x RS-875) failed to germinate. Amongst these F<sub>2</sub> populations, four (#2, #7, #12 and #22) gave fairly good seed cotton yield (>2000kg/ha). There, was an improvement in boll weight of these F<sub>2</sub> Progenies as compare to check variety RS 2013 (2.50g). The mean of average boll weight of the trial was 3.22g and range from 2.5 to 4.2g. Similarly, there was wide range for ginning out turn also (27.9 to 40.1%)

**Screening against biotic stresses:**

**CLCuV:** The introgressed material was screened against CLCuV disease under natural condition. Out of 22 genotypes screened, 20 showed resistance and 2 were found susceptible.

**Sucking Pests:** In this season, attack of Sucking Pests in this region was moderate. Out of 22 F<sub>2</sub> s screened, 13 were found tolerant and 9 susceptible against the attack of jassids. Similarly against whitefly, 16 were found tolerant, 2 moderately susceptible and 4 susceptible.

**Bollworm Damage:** American bollworm, *Helicoverpa armigera*, (Hubn.) could not make its appearance in the experimental plots. Spotted bollworm, *Erias insulana* (Boisd.) made regular appearance during the crop season and caused severe damage to squares and developing bolls of cotton plants. Boll damage during the crop season ranged from 2.80 to 9.04 percent.

**Quality parameters :** Twenty-five single plants based on quality traits, agronomic traits and resistance against CLCV were selected from these F<sub>2</sub>. Quality test were done for these selected plant and results showed a significant change over F<sub>2</sub> mean for all the traits except fiber fineness. Amongst these selected plants range for fiber length and fiber strength was 23.2 to 31.9mm and 18.1 to 29.1 g/tex, respectively.



## **CICR, Sirsa:**

### **❖ Evaluation of identified existing Introgressed lines.**

In this trial 6 entries of *G. arboreum* and 22 entries of *G. hirsutum* received during 2002-03 were evaluated in three replications against two local checks viz., RG-8 and RS 2013, respectively. Among the *G. arboreum* introgressed lines none of the entries could give significantly higher seed cotton yield over local check variety RG-8. Similarly, none of the *G. hirsutum* introgressed could give higher seed cotton yield over local check variety RS 2013. The highest ginning out turn of 38.8 % was recorded by *G. arboreum* line AKA-5. Three introgressed lines of *G. hirsutum* viz., TCH 1693 and Rai 11-3 also recorded more than 37% ginning out turn, which can be used for improving the local adapted cultivars. The 2.5 % span length was found to be maximum in TCH 1652 and TCH 1648 (28.6 mm). Uniformity Ratio ranged between 42 % (TCH 1648) to 53 % (AKA-5). The highest fibre strength of 22.6 was recorded by TCH 1648. For Jassid and whitefly reaction, all the Introgressed lines were found to be tolerant. For bollworm, only two lines i.e. TCH 1648 and Rai 7BSp<sub>12</sub> were found to be tolerant. For CLCV reaction all the lines were found to be tolerant.

### **❖ Evaluation of identified new introgressed lines.**

In this trial 2 introgressed lines of *G. arboreum* and 14 *G. hirsutum* were evaluated in one replication against local checks RG-8 and RS 2013. Highest seed cotton yield of 1646 Kg/ha was recorded in GISV-240. Only one entry GISV-240 could give yield at par with the local check variety RS-2013 (1646 kg / ha). However, both the entries of *G. arboreum* viz., HD 453 and HD 446 could record the highest seed cotton yield over the check variety RG-8 (686 kg/ha). *G. arboreum* line HD 466 recorded the highest ginning out turn of 41.2 %. Six entries of *G. hirsutum* Introgressed lines viz., GISV 216, GISV 238, RAC 023, RAC 027 and RAC 035 could record significantly higher ginning out turn (>37.0%) over the local check variety RS 2013 (34.0%). The 2.5 % span length was found to be highest in GISV-61 (26.3 mm). Uniformity Ratio ranged between 42 % (IS-14/21) and 56 % (RG-8). The highest fibre strength of 23.8 g/tex was recorded by GISV-61. For Jassid and whitefly all the lines were found to be tolerant. However, for CLCuV reaction all the lines except GISV-33 were found to be resistant.

❖ **Overcoming self incompatibility barriers in inter-specific- hybridization of wild and cultivated species**

**Study of incompatibility barriers in distant crosses.**

**South Zone :**

**TNAU, Coimbatore :** New crosses were made between wild diploid species ( $2n = 2x = 26$ ) like, *G.raimondii*, *G.armourianum* and *G.thryphyllum* and cultivated tetraploid *hirsutum* cotton varieties with the aim of transferring jassid and bollworm resistance from wild diploid species to cultivated tetraploid cotton varieties. Since the triploids obtained by crossing between wild diploid species and cultivated *hirsutum* varieties were sterile, they have been treated with colchicines to make fertile by doubling the chromosome number. Among the several triploids treated with colchicines only four plants viz., MCU 5 x *G.raimondii*, MCU 5 x *G.armourianum*, MCU 7 x *G.raimondii* and MCU 5 x *G.armourianum* , MCU 7 x *G.raimondii* and TCH 1609 x *G.armourianum* were identified as hexaploid by studying the morphological and cytological observations.

In all the four hexaploids, the boll development noticed as their pollen fertility was more than 80 per cent. The bolls produced in the hexaploids of MCU 5 x *G.raimondii* and MCU 7 x *G.raimondii* were found to have lint with well-matured seeds.

**Central Zone:**

**CRS, Surat :** Two crosses were included in the crossing programme Viz., CO2 x *G.sturtii* and (G.67 x MOCO) x *G.Cot-11*. Both were sterile and taken as female and pollinated with Digvijay (*G.herbaceum*) as male parent. After pollination, mixture of GA3 (50ppm) + NAA (100ppm) was applied at the base of flower. In (G.67 x MOCO) x *G.Cot-11* x Digvijay, only empty bolls were obtained, while in (CO2 x *G.sturtii*) x Digvijay, mature bolls were harvested with 13 number of seeds.

The (Sanjay x *G.thurberii*) pollinated with (*G.thurberii* x *G.raimondii*) x *G.Cot-10*. The chemical treatment was given as above. Only one seed was obtained. Both the crosses will be sown in next season for further study.

**CICR, Nagpur :** New crosses were affected between long staple *G. arboreum* genotypes with wild species. It has been observed that cross PA-183 x *G.trilobum* recorded highest boll setting of 18.2 %, followed by cross AKH-4 x *G.raimondii* (10%) and cross AKH-4 x *G.aridum* (9%). The seed setting percentage was however very low. In the cross PA-183 x *G.trilobum* out of 18.2% boll set, only 2

emasculated flowers could set seed, while, there was no seed setting in other two flowers. In cross G-27 x *G. anomalum* 3 flowers could set out of 35 pollination, but seed setting was low. Likewise in AKA-8401, AKH-4, AKA-5 cross with MCU-5 there was 2.72, 0.96 and 1.81% of boll setting contains 2 and 1 seed in first two crosses respectively. It has been observed that in many crosses, there was no seed set at all.

❖ Standardization stages of embryos (ages) and media combination etc.

#### **South Zone :**

**CICR, Coimbatore :** Triploid hybrid plants have been established from the crosses effected between the cultivated species *viz.*, *G. hirsutum* cultivars LRA 5166, Sumangala, Anjali and Surabhi and the wild species *viz.*, *G. armourianum*, *G. raimondii* and *G. aridum*. Efforts were made to double them under *in vitro* condition using shoot tip culture. In all the combinations, shoot tips survived for a very few days and showed little perceptible growth even after 30 days in culture. Nearly 50 days after culture, in few combinations, the auxiliary buds started to sprout. The technique needs further refinement and standardization.

#### **Central Zone:**

**CICR, Nagpur :** For invitro studies ovule culture, two media combinations were tested. There were 2,4-D (0.1 mg/L) + Kinetin (0.1 mg/L), NAA (2 mg/L) + Kinetin (1 mg/L) in both the media 1.0 mg/L GA 3 was added. The ovules after 10, 12 and 15 DAP interval were removed from the five crosses *viz.*, PA-402 x *G.anomalum*, PA-255 x *G.trilobum*, G-27 x *G.anomalum*, PA-183 x *G.trilobum* and AKH-4 x MCU-5. It has been observed ovules excised from 12 and 15 DAP responded more towards callusing. The responses such as enlargement of ovules and formation of embryo axis were observed in 15 DAP ovules of all crosses.

Development of tetraploid and diploid genotypes through introgression breeding for

- a) Better fiber properties
- b) Biotic stress resistance like jassid, white fly, bollworm, alternaria, bacterial blight, grey mildew and CLCuV
- c) Abiotic stress resistance like drought and water logging
- d) Male sterility

**To effect crosses between wild and cultivated species, tetraploid and diploid species**

**South Zone**

**TNAU, Coimbatore**

**Introgression of biotic resistance genes**

1	<i>G.hirsutum</i> race <i>palmeri</i>	Using cultivated tetraploid <i>G.hirsutum</i> varieties / accessions as male and female parent
2	<i>G.hirsutum</i> race <i>morilli</i>	
3	<i>G.hirsutum</i> race <i>punctatum</i>	
4	<i>G.hirsutum</i> race <i>richmondii</i>	

The crosses were made between the four *G. hirsutum* races and MCU 5, MCU 12, SVPR 3 and KC 2 during 2003-2004. Simultaneously the F<sub>1</sub> populations were backcrossed with their parents and the back crossed bolls were harvested and processed. These F<sub>2</sub>'s and back crossed seeds will be evaluated during 2005-2006 for their segregation.

**CICR, Coimbatore :** Wild species available in the station viz., *G. gossypoides*, *G. triphyllum*, *G. davidsonii*, *G. aridum* and *G. armourianum* were crossed as pollen parents on agronomically superior cultivars of *G. hirsutum* (Sumangala, LRA 5166, Anjali and Surabhi) and *G. arboreum* (K 10 and K 11) in all possible combinations. Seeds were obtained successfully in few crosses.

**LAM Guntur :** The following wild species/races utilised in crossing programme :

<u>Wild species</u>	<u>Genome</u>	<u>Character aimed for</u>
1. <i>Anomalum</i>	B1	Fibre quality improvement, bollworm and sucking pests tolerance and Bacterial blight.
2. <i>Thurberi</i>	D1	Fibre quality improvement and bollworm and sucking pests tolerance
3. <i>Cernuum</i>	A2	Pink bollworm, drought tolerance
4. <i>Bengalence</i>	A2	Pink bollworm and <i>Helicoverpa</i>
5. <i>Palmeri</i>	AD1	Sucking pests and boll worms
6. <i>Somalense</i>	E2	Sucking pests and bollworms
7. African	A1	Drought tolerance
8. Moco -local		Drought tolerance and bollworms

**Central Zone:**

**CRS, Surat :** During 2003-04, seven crosses were made with released varieties of *G.hirsutum* cotton G.Cot-10 and G.Cot-16 using them as female parents and pollinated with multispecies derivatives as male. The chemical treatment of GA3

(50ppm) + NAA (100ppm) was given after pollination at the base of the flower. Only two crosses germinated and bolls were harvested for further study.

**PDKV, Akola** : During the year derivatives of wild species namely, (*G.arboreum* x *G.anomalum*, *G.arboreum* x *G.raimondii* and *G.arboreum* x *G.thurberi*) backcrossed with the cultivated diploid species and (*G.hirsutum* x *G.raimondii*) backcrossed with the cultivated tetraploid species, *G.barbadense* and such progenies derived were evaluated during this year in F<sub>3</sub> generation as indicated below.

<b>Crosses</b>	<b>No. of Lines</b>
( <i>G.arboreum</i> x <i>G.anomalum</i> ) x HD-110-151	13
( <i>G.arboreum</i> x <i>G.thurberi</i> ) x KWA-11	10
( <i>G.arboreum</i> x <i>G.raimondii</i> ) x KWA-11	7
( <i>G.hirsutum</i> x <i>G.raimondii</i> ) x ERB-4492	16

During the year wild species *G.anomalum*, *G.raimondii*, *G.thurberi*, and *G.aridum* were used for crossing programme. The crosses made are given in the next table 1.3.2.

**Table 1.3.2 :**

<i>G.hirsutum</i>	X	<i>G.anomalum</i>
<i>G.hirsutum</i>	X	<i>G.raimondii</i>
<i>G.hirsutum</i>	X	<i>G.aridum</i>
<i>G.hirsutum</i>	X	<i>G.barbadense</i>
<i>G.arboreum</i>	X	<i>G.anomalum</i>
<i>G.arboreum</i>	X	<i>G.raimondii</i>
<i>G.arboreum</i>	X	<i>G.thurberi</i>
<i>G.arboreum</i>	X	G.herbaceum

The derivatives of these interspecific crosses are in different stages of development and evaluation process.

**CICR, Nagpur** : To accomplish basic activity of MM 1.3 project, crossing program was attempted involving a wide array of sources of resistance to major biotic and abiotic factors, better fiber properties, & gossypol free oil based on stability of performance over locations and years available in the gene pool maintained at Nagpur centre. Interspecific cotton breeding using wild species was carried out to

fulfill the cited objectives. During the reported period several crosses were affected between the cultivated species using about 10 cultivars as pollinators and 15 wild species & 6 races as female parent. Cultivars, namely, Laxmi, Kh 2, Kh 3, MCU 5, CNH 120, LD 1134, F 414, LRK 516, Sahana, and NISD 5 were used as male parents in hybridization program. Reciprocal crosses were also attempted among wild species. This exercise was attempted from September through November. Boll set was good in crosses attempted in September-October when temperature was favourable.

In addition to the above, this activity was further extended involving crosses between stable fertile introgressed selections of diploid and tetraploid cotton received from various cooperating centers & cultivated varieties and hybrids. Introgressed lines were used as parents in various combinations to transfer their scored traits and also to improve their traits. Introgressed Rai lines developed at CICR, Nagpur were also crossed with well known existing varieties adopting reciprocal crosses. Approximately, 1000 pollinations were made among stable introgressed lines using 12 varieties as pollinators, namely, G. Cot 100, Kh 3, Suvin, G 67, H777, MCU 5VT.

#### **North Zone:**

**IARI, N. Delhi :** Large numbers of new crosses were attempted this year with the aim to transfer CLCuV resistant character from the introgressed lines. Forty-four crosses were successful.

#### **South Zone:**

##### **TNAU., Coimbatore :**

**Experiment I:** Among the test entries, Abadhita x AKH 2051 was early in 50 per cent boll bursting (118 days) when compared to check (>120 days). The check MCU 13 recorded the highest single plant yield of 111.5 g/plant. Among the test entries, five entries recorded an yield of >100g/plant. Except five entries, all the test entries registered more than 4g of boll weight while the check MCU13 recorded the highest boll weight (5.6g). The entries, Abadhita x TCH 3 and Abadhita x MSH P 53 recorded a seed index of 10 and 10.2 g respectively. The mean bad opening boll per cent was lowest 13.3% in (GISV 197 x GISV 61) x RS 875 followed by IS 376/4/2-9 x RS 2013 (13.8 per cent) were the highest was 27.1 per cent in Saravottum x

KWAN 4. Eight entries showed resistance reaction to jassids. The span length was highest (27.4 mm) in Abadhita x TCH 2 which, Saravottum x KWAN 7 recorded a bundle strength of 22g/tex with a strength/length ratio of 0.91 where none of the entries had more than 0.80 of strength/length ratio including checks.

**Experiment II:** Among the tested entries A x Surat 5/2 recorded a plant height of 110 cm while Ax AKH 2053/7 had 20 sympodia. A x Surat 2/8 had early 50 % boll bursting and comparable with checks. The check MCU 5 recorded the highest mean single plant yield of 112.56 g followed by MCU 12 (110.5 g). Among the test entries A x Surat 5/2 was 88.50 g and A x AKH 2053/7 87.66 g were high yielder. The boll weight of 4.98 g. was comparable with the checks MCU 13 (5.1 g) and MCU 12 (4.98 g). The GOT was highest 40 % in A x Surat 2/8 followed by 38.3 % (A x Surat 5/2). The highest GOT of 42.9 % was recorded in A x Surat 2/8. Among the test entries A x Surat 5/4 registered 9.2 g of seed index, while the check MCU 5 recorded the highest seed weight (11.58 g). Ax AKH 2053/7 had jassid score of 1.0, while all other entries recorded 2.0 as score. The percent of bad opened bolls was as low as 3.7 (A x surat 5/4) to as high as 38.4 (A x Rai / 9). The entry A x Surat 2/5 recorded a mean of 17.9 % bad boll opening. None of the test material exceeded 30 mm span length including the checks. The highest strength / length ratio of 0.76 was recorded by A x Surat 2/5 while the highest of 0.83 was also recorded by the same entry. The checks MCU 12 recorded 0.74 as strength/ length ratio.

**CICR, Coimbatore :** The progenies of introgressed lines obtained from various cooperating centres were evaluated for yield and other characters for utilizing them in breeding programmes. Single plants were also selected in some of the advanced progenies.

Based on morphological and yield characters, 205 plants have been selected from the segregating lines received from various cooperating centres during the current year (2004-05). There are wide variability observed in these plants for seed cotton yield and other agronomic characters recorded. The seed cotton yield ranged from 26 to 200 g/plant, whereas the mean seed cotton yield was 78.4 g/plant. Similarly, from the segregating lines received during the year 2003-04 about 223 plants were selected and in these plants also wide variability was noticed. In these plants, the yield ranged form 24 to 170 g/plant with the mean seed cotton yield being 86.5

g/plant. About 142 plants have been selected from the segregating lines obtained during the year 2002-03. In these lines, the yield ranged between 30 g/plant and 150 g/plant, whereas the mean of all was 150 g/plant. Several plants were superior for characters like ginning outturn, lint index and seed cotton yield

Single plant selections (95 in number) were also effected in some of the advanced lines obtained from the inter-racial cross derivatives. The genotype IRH 1-4 was found to have more than 42% ginning outturn during the previous year of evaluation. In this genotype, about 25 plants were selected based on morphological characters. When sampling was done, it was found that several plants were found to have more than 42% ginning outturn and as high as 44.9 % was recorded in the progeny IRH 1-4-7. These plants were also characterized by correspondingly high lint index and seed index.

#### **LAM, Guntur :**

The lines received from different cooperating centres were screened for various biotic stresses under unprotected field condition. Aphid and thrips incidence was appeared nil in the cross LRA 5166 X IGM 42 (F<sub>2</sub>). Where as nil jassid incidence was noted in entries AKH 0302, AKH 0303, (G. cot 10 XGISV 61) RS 875, Rai 11 and MSH 53 with jassid injury grade I. Low pink bollworm damage on locule basis was observed in LRA 5166 X IGM 42 F<sub>2</sub>. In case of diploids, low jassid incidence was noted in the entries G. cot 11 x AH 32-3 F<sub>2</sub>, Dighvijay X Hh<sub>2</sub>, Sarvotham X KWA 7 F<sub>2</sub> with jassid injury grade I. Low pink bollworm damage on locule basis was noted in the entry AKA 03011.

The yield differences among the entries evaluated were found significant. Higher seed cotton yield of 109.6 g was recorded by diploid cotton entry HD 463 followed by Sarvottam X PA 405 F<sub>2</sub> (104.25 g) and Sarvottam X Paig 8/3 F<sub>2</sub> (79.20g).

Highest fibre length of 28.93 mm was recorded by KWIS 36 followed by AKH 0304 (28.72 mm) and TCH 1648 (28.62 mm) entries. In diploid cotton highest fibre length of 28.96 mm was noted by G. cot 11 X AH 32-3 F<sub>2</sub>. Highest fibre strength of 23.8 g/tex was recorded by Abaditha X IV-2 F<sub>2</sub> followed by MSH 45 (22.8 g/tex).



### Study of segregating material

The following segregating populations are studied and based on the phenotype performance selections are made. They will be further screened based on their fibre qualities.

Segregating generations	No. of crosses	No. of progenies studied	No. of lines selected
F <sub>2</sub>	20	--	40
F <sub>3</sub>	25	67	23
F <sub>4</sub>	10	17	13

#### UAS, Dharwad:

**Set I:** Twenty-two diploid crosses developed by using cultivated and wild species at Lam Guntur and Dharwad stations were advanced to further generation. The maximum seed cotton yield was observed in LAS 2 x IGM 20 (784 kg/ha) followed by L601 x Palmeri (766 kg/ha), (Arb. x MSH 345) W 12) (721 kg/ha) and LAS-2 x IGM 19 (693 kg/ha). The average seed cotton yield was 440 kg/ha with a range of 96 kg/ha (Arb x MSH 346-3) to 784 kg/ha (LAS 2 x IGM 20) was observed. The maximum boll weight was observed in (Arb x MSH 345) W12 (3.7g), which also recorded numerically higher seed cotton yield and minimum boll weight was observed in Ab x MSH 346 (1.5g). The F<sub>2</sub> generation of all these crosses will be screened for isolation of desirable genotypes.

**Set II:** Twenty-five diploid crosses developed at Dharwad station during the previous year were advanced to further generation in unreplicated trial. The maximum seed cotton yield was observed in *herbaceum* x GMF2 P24 (659 kg/ha) cross followed by *herbaceum* x GM plant 7-1 (494 kg/ha), *Sudanense* x F1 GM (435 kg/ha) and *herbaceum* x GM 04 (380 kg/ha). The mean seed cotton yield was 242 kg/ha with a range of 23 kg/ha (*Bengalense* x F1 GM) to 659 kg/ha (*herbaceum* x GMF2 P24). The maximum boll weight was observed in *Cernum* x (Jayadhar x GM) (1.9g) and minimum was in *Sinensis* x GM P24 (0.6g) cross. The F<sub>2</sub> generation of all these crosses will be screened for isolation of desirable genotypes.

**Set III:** F<sub>2</sub> generation of seventeen tetraploid crosses developed at Dharwad centre were screened for yield and quality parameters in unreplicated trial. The maximum seed cotton yield was observed in CPD 420 x *Richmondii* (780 kg/ha) followed by (CPD 420 x Palmeri) x DC 59 (563 kg/ha), DC 57 x GM (560 kg/ha) and CPD 420 x Palmeri (537 kg/ha). The higher boll weight was observed in DC 56 x SIU-135

(4.1g) followed by DC 57 x GM (4.0g) cross. Forty-one IPS were made from these 17 crosses based on phenotypic observations and also tested for their fibre quality. The maximum staple length was observed in DC 59 x Morilii (33.1 mm) followed by DC 59 x Suvin (32.1 mm) and DC 57 x GM (30.0mm) IPS. The maximum fibre strength was observed in DC 57 x GM (25.7g/t) followed by CPD 420 x *Punctatum* (24.2 g/t), DC 59 x *Punctatum* (23.6 g/ha) and DC57 x *Punctatum* (23.6 g/t) IPS. The IPS from DC 57 x GM recorded staple length of 30.0 mm and also recorded maximum fibre strength of 25.7 g/t. The maximum staple length recorded by IPS from DC 59 x morilii (33.1mm) which also had higher fibre strength (23.5g/t).

**Set IV:** Twenty-eight diploid crosses developed by using cultivated species at Dharwad and Hissar centre were evaluated under unreplicated trial for yield and other parameters. The maximum seed cotton yield was observed in DLSa 17 x RAC 029 (702 kg/ha) followed by G. Cot 16 x GISV 16 (659 kg/ha), Jayadhar x AKA 8 (615 kg/ha) and DLSa 17 x AKDH 5 (603 kg/ha). The average seed cotton yield was 397 kg/ha with a range of 86 to 702 kg/ha. The maximum boll weight was observed in G. cot 16 x GISV 61 (2.6g) and minimum in HD-446 x (Arb x Her) (1.4 g) cross.

**Set V:** F<sub>3</sub> generation of ten tetraploid crosses developed through introgression breeding at Dharwad centre were evaluated under unreplicated trial for yield and quality parameters. The cross AH 131 x IGM4 produced maximum seed cotton yield of 1980 kg/ha followed by IGM 102 x NA 1325 (1641 kg/ha) and IGM 100 x CWROK 165 (1551 kg/ha). The highest yield-producing cross also produced maximum boll weight of 3.5 g. Twenty-six IPS were made from these 10 crosses (F<sub>3</sub> stage) based on morphological characters and also tested for there fibre quality. The staple length in the selected lines ranges from 20.8mm (HD-219 x PA 304) to 27.5 mm (HD 107/98 x PA 141 IPS-1). The maximum fibre strength was observed in HD 107/98/ x PA141 IPS2 (23.6g/t) and minimum in HD 219/98 x PA304 IPS1 (17.4 g/t). The IPS from the cross HD 107/98 x PA 141 had highest staple length as well as fibre strength also.

**Set VI:** F<sub>4</sub> generation of thirty-nine tetraploid crosses and eight diploid crosses developed at Dharwad centre were evaluated under unreplicated trial for yield and quality parameters. Among the *hirsutum* lines, Abadhita x MSN 345 (3220 kg/ha) recorded maximum seed cotton yield followed by Abadhita x AKN 2053 (2535

kg/ha) and Abadhita x IV-2 (2416 kg/ha). The line Sarvottam x PA 405 recorded maximum yield (1913 kg/ha) followed by Sarvottam x KWAN-4 (1799 kg/ha) and Sarvottam x KWAN-7 (1767kg/ha) among *arboreum* crosses. The maximum boll weight of 6.3g was recorded by IRH-1-4 SPS-10. Average boll weight was 3.7 g with range of 2.6 g (Sarvottam x KWAN-7) to 6.3g (IRH-1-4 SPS-10). Ninety Four IPS from these 47 crosses of F<sub>4</sub> stage and all these IPS were tested for their fibre properties. The maximum staple length was observed in LRA 5166 x IGM 42 (30.5 mm) followed by LRA 5166 x IGM 27 (29.9 mm), Abadhita x TCH-2 (28.8 mm) and (G. cot 10 x GISV 79) RS 875 (28.8 mm). The mean staple length was 25.6 mm with a range of 21.8 mm (AKDH-36) to 30.5 mm (LRA 5166 x IGM 42). The maximum fibre strength was recorded by LRA 5166 x IGM 42 (26.7g/t) followed by LRA 5166 x IGM 27 (25.4g/t), (GISV-185 x S. dwarf) x RS 2013 (25.0 g/t) and LRA 5166 x MSN 345 (24.4 g/t). The mean fibre strength was 21.7 g/t with a range of 18.7 g/t to 26.7 g/t. The IPS from the cross LRA 5166 x IGM 42 recorded maximum staple length (30.5 mm) and fibre strength (26.7g/t) with micronaire value of 3.6 followed by the IPS from the cross LRA 5166 x IGM 27.

#### **CENTRAL ZONE:**

**CRS, Surat:** In all, 78 introgressed materials received from different centres viz; Surat (11), Coimbatore (11), Akola (8), Hisar (2), Dharwad (27), Nanded (2), Khandwa (5), Rahuri (5), Nagpur (6), IARI New Delhi (1) and one check G.Cot-16 were evaluated at Surat in single row with two replications under protected condition. Out of 79 entries, six entries viz., IRH-1-4, TCH-1648, Rai-3-1, MSH-53, MSH-45 and Pusa-8-6 were adversely affected by heavy and continuous rains resulted in poor plant stand, therefore not considered in analysis.

A total of 55 genotypes of tetraploid group were evaluated of which eight genotypes were significantly superior in their yield performance to check G.Cot-16 (1092 Kg/ha). The genotype Abadhita x MSH-SP-53 F2 (1792 Kg/ha) ranked first in seed cotton yield followed by GISV-61 (1673 Kg/ha) and GISV-206 (1614 Kg/ha). In lint yield, GISV-61 (647 Kg/ha) ranked first followed by GISV-206 (570 Kg/ha) and Abadhita x MSH-SP-53 F2 (564 Kg/ha). The GOT values of these entries ranged from 27.9(KWIS-28/KH-22-5) to 38.7 % (GISV-61). The maximum boll weight recorded in TCH-1692 (3.84g) followed by TCH-1652 (3.83g). In respect to fibre quality parameters, these entries were medium to extra long staple (24.3 to 33.1

mm) with fine to coarse fibre (3.8 to 5.5 mv), good in maturity (0.84 to 0.87), low to very good tenacity (19.7 to 26.2 g/tex) and average to excellent uniformity ratio (44 to 54%). From the overall performance, entry GISV-206 was found promising as it recorded higher seed cotton yield (1614 Kg/ha), lint yield (570 Kg/ha), ginning percentage (35.3%), mean fibre length (28.0 mm), fineness (4.6 mv) with high rate of tenacity (26.2 g/tex).

The entries viz., AKH-0305, Abadhita x Surat-4 (F2), Abadhita x AKH-2031 (F2) and Abadhita x Rai (F2) were found moderately tolerant to bollworms (<15% damage), while, the entries viz., (Ponduru x ARB-F-28) x Jaydhar tapti (F2) and Rai-3 were found tolerant to bollworms (<10% damage). The following entries viz., GISV-33, GISV-61, GISV-203, AKH-0306, Abadhita x TCH-3 (F2), Abadhita x IV-2 (F2), (Ponduru x ARB-F-28) x Jaydhar tapti F2, IS-30/68, KWIS-11, KWIS-49, Rai-4, Rai-11 and Rai-3 were free from bacterial leaf blight disease.

A total 18 genotypes of diploid group were evaluated. ANOVA revealed significant varietal differences for seed cotton yield. The maximum seed cotton yield, was recorded in HD-453 (926 Kg/ha) followed by AKH-0311 (855 Kg/ha). The entry HD-926 maintained its superiority in lint yield (341 Kg/ha) also followed by HD-446 (328 Kg/ha).

With respect to fibre properties, these entries were short to medium long in staple length (17.4 to 26.2 mm) with very coarse to average in fineness (7.2 to 4.2mv), good in maturity (0.85 to 0.87), low to very good tenacity (16.1 to 26.0 g/tex) and good to excellent in uniformity ratio (46 to 57%).

From the overall performance, the entry HD-453 was found promising for seed cotton yield (926 Kg/ha) as well as lint yield (341 Kg/ha). In respect of fibre quality, G.Cot-11 x AH-32-3 F2 was found promising as it possessed 25.9 mm span length, 4.2mv fineness and 26.0 g/tex tenacity. Total seven entries, viz., Digvijay x Hh-2 F2, AKH-0311, AKH-0312, HD-453, HD-446, RAC-027 and RAC-032 showed tolerance to bollworms (<10% damage), while all the entries showed disease free reaction.

### **Evaluation of introgressed material for yield and abiotic reaction.**

The trial was laid out at different locations with different objectives, Viz., Surat for yield, fibre quality and biotic stress, at Danti for salinity and fibre quality, at Bharuch for drought and biotic stress, at Dhandhuka and Porbandar for drought

and fibre quality. The trial consisted of 14 introgressed materials (six introgressed materials from tetraploid and six from diploid cotton) along with two checks G.Cot-23 and G.Cot-16 were evaluated at Surat, Bharuch, Danti, Dhandhuka and Porbandar.

**SURAT:** The differences in seed cotton yield were found significant. None of the genotypes were found significantly superior over check G.Cot-16 in tetraploid group and G.Cot-23 in diploid group. Numerically, SRIS-2 (506 Kg/ha) and SRIS-7 (413 Kg/ha) recorded maximum seed cotton yield for tetraploid and diploid cotton, respectively. Maximum GOT values i.e. 34.7 and 34.2% recorded by (SRIS-4 in tetraploid and SRIS-11) in diploid cotton respectively. The individual plants were selected on the basis of earliness, quantitative and qualitative parameters for further evaluation.

Further, the following trials were evaluated for selection of superior fibre properties in the segregating population. The individual plants selected on the basis of earliness, boll size, boll opening, plant height and having good fibre quality in the segregating population are indicated in the next table :

Sl. No.	Name of trial	No. of entries	No. of total plants	No. of selected plants
1	Evaluation of introgressed material for yield, Fibre quality and biotic reaction.	79	948	170
2	Evaluation of multispecies derivatives for different biotic and abiotic stresses, yield and fibre quality	14	784	99
3	Study of F2 and F3 generation in diploid cotton developed by using introgressed material.	15	900	55
4	Evaluation of back crosses BC1F2 and BC2F5 generation for yield and other economic characters.	6	252	33
5	Evaluation of introgressed material for yield and abiotic reaction.	14	392	44
6	Study of F1 generation in diploid cotton developed by using introgress material (Set I).	28	336	74
7	Study of F1 generation developed by using interspecific derivatives and G.barbadense cotton. (Set-II)	28	336	43
8	Study of F1 generation developed by using interspecific derivatives, exotic and G.hirsutum cotton. (Set-III)	28	336	33
9	Study of BC1F1 crosses for further evaluation	18	252	12

### **Evaluation of introgressed material for yield and biotic reaction.**

Out of 14 entries, all the entries were found tolerant to aphids, jassids, thrips and whitefly except entries Viz., SRIS-2, SRIS-4 and SRIS-5, which recorded jassids population above ETL. In case of bollworm damage, all the entries recorded less than 5% damage to squares except entry SRIS-2, while entries Viz., SRIS-1 and SRIS-7 recorded less than 15% bollworm damage to square, open boll and locules, which found tolerant to boll worm.

For biotic reaction to bacterial blight at Surat, the results revealed seven, three, three and one entries found disease free, moderately resistance, moderately susceptible and susceptible to bacterial blight, respectively. Incidence of other disease did not appear during the season.

### **Screening under drought and water logging conditions.**

**Bharuch:** Among tetraploid introgressed material, none of the genotypes was found superior to check G.Cot-16 (2422 Kg/ha) for seed cotton yield. Numerically, SRIS-6 recorded maximum seed cotton yield (2404 Kg/ha) as well as lint yield (767 Kg/ha) Maximum ginning percentage (35.3%) and boll weight (3.1 g) was recorded by SRIS-1. The genotypes, viz., SRIS-1, SRIS-2, SRIS-3 and SRIS-4 were found susceptible to sucking pest.

Amongst diploid, none of the genotypes were found superior to check G.Cot-23(3058 Kg/ha) for seed cotton yield. The genotype SRIS-9 (2815 Kg/ha) recorded maximum seed cotton yield followed by SRIS-7 (2691 Kg/ha) and SRIS-10 (2667 Kg/ha). The SRIS- 7 (893 Kg/ha) recorded maximum lint yield. The GOT values ranged from 31.6 (SRIS-9, SRIS-10) to 34.5% (SRIS-11, SRIS-12). The maximum boll weight was recorded by SRIS-9 (2.8g). Only one genotype SRIS-9 was found tolerant to drought. The individual plants were selected on the basis of plant type, earliness, quantitative and qualitative characters

**Porbander :** Among tetraploid cotton group, only one genotype SRIS-1 (1316 Kg/ha) proved significantly superior to check G.Cot-16 (568 kg/ha). Among diploid group, none of the genotypes was observed significantly superior to check G.Cot-23 (490 Kg/ha). The maximum seed cotton yield was recorded by SRIS-7 (520 Kg/ha). The maximum GOT value was recorded by SRIS-5 (40.5%) and boll weight in SRIS-2 (2.4g) tetraploid and SRIS-11 (1.70g) diploid.

**JNKVV, Khandwa:****❖ Evaluation of introgressed materials received from different centers.**

**Yield and Ginning Percentage :** The data on the seed cotton yield indicate that IAS-30/68 was the highest yielder closely followed by AKA-0512 and GISV 216. The data also indicate that G.Cot 11 x AH 32-3 gave the highest ginning percentage closely followed by AKA 0311. It is interesting to note that three entries viz. AKA 0311, GISV 240 and TCH 1691 gave very good seed cotton yield and have a high ginning percentage.

**Fibre quality:** The lint samples of all the 58 entries have been assessed for their fibre properties. The top performers in respect of fibre length, fibre strength and overall fibre quality are presented in the following table 1.3.3 & table 1.3.4.

**Table 1.3.3 : Top performers: Fibre length & Strength**

Sl. No.	Entry	2.5% SL (mm)	Sl. No.	Entry	g/tex
1	GISV-206	27.4	1	GISV-206	24.7
2	GISV-238	28.0	2	G.Cot-11 x AH-36-1	22.7
3	AKH-0301	28.0	3	G.Cot-11 x HH-36-1	24.0
4	AKH-0304	27.7	4	AKH-0301	22.3
5	TCH-1648	29.8	5	AKH-0303	22.6
6	TCH-1649	28.1	6	AKH-0305	22.6
7	TCH-1652	27.9	7	TCH-1649	22.0
8	TCH-1695	29.6	8	KWIS-28	24.2
9	TCH-1696	28.6	9	KWIS-36	22.7
10	KWIS-28	29.5	10	HD-0453	22.9
11	KWIS-36	29.2	11	Abadhita x Rai	23.4
12	Abadhita x Rai	29.2			
13	Abadhita x TCH-3	27.6			

**Table 1.3.4 : Overall Fibre Quality basis**

Sl No	Entry	2.5% SL (mm)	MV	g/tex (3.2 mm)	Elg. %
1	KWIS-28	29.5	3.7	24.2	5.9
2	Abadhita x Rai	29.2	4.0	23.4	5.6
3	GISV-206	27.4	4.2	24.7	6.1
4	KWIS-36	29.2	3.3	22.7	5.3
5	AKH-0301	28.0	4.1	22.3	5.8
6	AKH-0303	27.1	4.0	22.6	5.2
7	TCH-1649	28.1	4.1	22.0	5.6

**Bollworm resistance:** The data on square damage (%) and boll damage (%) indicate that considering both the parameters all the entries viz., KWIS 19, TCH 1648, Abhadita x TCH 2, Abhadita x TCH 2053, Abhadita x TCH 3, IS 376 x RS 875, HD 446 and G.Cot 11 x AH 32-33 exhibited lower bollworm damage.

**Resistance for Myrothecium Leaf spot and Bacterial blight :** All the 58 entries were scored for their reaction towards two diseases viz. MLS and BLB. The reaction has been recorded on a 0-4 scale with reactions 0,1 and 2 depicting resistance/tolerance. The data clearly indicate that the entries are resistant to bacterial leaf blight and Myrothecium leaf spot as well. These entries need to be tested for at least one more season to confirm their reaction with adequate selection pressure.

**Selections:** 265 selections have been made from both these trials with an object to make single plant selections for fibre quality traits (Fibre length > 28 mm, strength > 25 g/tex and micronaire between 3.8 and 4.2).

**OUAT, Bhawanipatna:**

❖ **Evaluations of inter specific cross derivatives for performance of seed cotton yield and other characters.**

This experiment consisted of 43 cultures derived from inter specific crosses of cotton at various centres. Maximum seed cotton yield was recorded in TCH-1696 (26.57 q/ha) followed by AKH-0303 (26.40 q/ha). The range of seed cotton yield was from 10.92 q/ha (HD-453 (*arb.* X *herb.*)) to 26.57 q/ha (TCH-1696) with the mean of 19.64 q/ha. The entries TCH-1696 (26.57 q/ha), AKH -0303 (26.4 q/ha), TCH-1649 (25.54 q/ha), TCH-1691 (24.82 q/ha), Abadhita X IV-3 (24.21 q/ha), Abadhita X TCH-3 (24.99 q/ha) and Abadhita X Surat-5 (24.31 q/ha) were significantly out yielded the checks Hy-19 and Hy-23.

The ginning outturn recorded was maximum in AKH-0312 (42.18%) followed by AKH-0311 (41.14%). The lint yield ranged from 4.13 q/ha (*arboreum* X *barbadense*) to 9.44 q/ha (Abadhita X Surat-2) with the mean of 7.11 q/ha. The range of boll weight was from 2.07 g (Hy-16) to 5.09 g (TCH-1692). Abadhita X Surat-4 was the earliest among all the entries (108 days) whereas Hy-23 and Hy-17 were the late ones (134days).

114 single plants were selected from introgressed cultures according to their *per se* performance and manual measurement of fibre quality parameters.



### **CRS, Nanded :**

#### **Evaluation of introgressed genotypes sponsored by different centers.**

*G. arboreum* genotype from Khandwa namely KWA-5-4, KWIS-5-4 and culture Sarvottam x KWA-N-4, Abadhita x Surat-4, Abadhita x Rai from Dharwad, AKH-0312 from Akola, HD-453 from Hissar were found superior for seed cotton yield and recorded significantly higher yield over arboreum check, PA-183 and hirsutum check, NH-545. The culture Abadhita x TCH-6 has good combination of yield (806 kg/ha), M.H.L. (26.42 mm) and Ginning Out turn (38.5 %). Single plant selections based on plant type, boll number and fibre characters were made in above cultures.

#### **Evaluation of promising introgressed cultures**

The promising cultures identified during 2003-2004 were tested in comparison with arboreum check, PA-183, hirsutum check, NH-545 and HxH hybrid NHH-44. Three cultures, viz., Pondaru x arb., Rai-24, Sarvottam x MW-7 were found superior for seed cotton yield and recorded significantly higher yield over checks NH-545 and PA-183. Genotype IS-376/4/2/20/1 was found significantly higher yielder than hirsutum check, NH-545 and hybrid NHH-44, but was at par with arboreum check PA-183. Two genotypes namely TCH-1696 and Rai-7B were found superior for G.O.T. (39.2 %) while, TCH-1695 was found superior for staple length (26.9 mm).

#### **Commercial exploitation of apomictic gene for fixing heterosis in promising hybrids and isolation of superior pure lines**

Utilizing Apomictic lines viz. 181/7/1 and 244/4/2 as male parents and hybrids as female, three way crosses were affected during 2002-03 and 2003-04. 18 three way F<sub>1</sub>'s, 18 F<sub>2</sub>'s and 58 F<sub>3</sub>'s progenies were evaluated during 2004-05 along with respective hybrid checks. Most of the three way cultures have shown morphological uniformity.

### **PDKV, Akola :**

**Experiment I :** Total 68 genotypes have been evaluated for the yield and yield contributing characters. The results were statistically significant for yield. The genotype RAC-027 ranked first (441.5 g/plot) followed by RAC-035 (425.7 g/plot) and Abadhita x Rai (367.5 g/plot).

### **Biotic Stresses**

**Jassids** : 13 genotypes recorded resistant grade, 44 genotypes recorded moderately resistant grade, nine genotypes recorded susceptible grade and two genotypes responded highly susceptible to Jassids.

**Bollworm complex** : Locule damage due to bollworm complex in different genotypes ranged from 0.0 % to 25.0 %. The lowest locule damage for bollworm complex was recorded in IS-14/21 and Digvijay x Hh-2 (F<sub>2</sub>) (0.0 %) followed by Abadhita x Rai and Rai-3 (1.6 %), while highest locule damage was found in Abadhita x AKH-2053 (25.0 %) followed by GISV-240 (23.3 %).

**Pink Bollworm:** Locule damage due to pink bollworm ranged from 0.0 % to 25.0 %. The highest locule damage was recorded in Abadhita x AKH-2053 (25.0 %) followed by GISV-240 (23.3 %), while lowest infestation was recorded in IS-14/21 and Digvijay x Hh-2 (F<sub>2</sub>) (0.0 %) followed by Abadhita x Rai and Rai-3 (1.6 %).

**Experiment II** : Under this activity the interspecific derivatives received from different centers during the year 2001-02, 2002-03 and 2003-04 were sown for selection of superior types among these genotypes. Overall 20 genotypes were selected for yield and fibre quality parameters. Remaining genotypes are maintained for further evaluation.

During the year the selected F<sub>4</sub> plants were raised to grow in F<sub>5</sub> generation to evaluate yield, fibre and reaction to pests and diseases. Total 83 Nos. of segregating population were raised to study the further behavior of genotypes and to test resistance to sucking pests and yield performance. Again selection pressure was exerted to identify desirable genotypes from the existing interspecific derivatives. The genotypes vary in yield between 15.18-to 31.93-gm/ plants. The genotype SPS/78 recorded highest yield (31.93gm/plant) followed by SPS-74 (30.61 gm/plant).

### **CICR, Nagpur:**

#### **❖ Screening introgressed *Gossypium* material against biotic stresses**

The entire introgressed *Gossypium* materials emanating from three species viz. *arboreum*, *herbaceum* and *hirsutum* were screened against three economically important sucking pests (Jassid, aphid and whitefly), bollworm damage and fungal/ bacterial diseases (*Alternaria* leaf spot, bacterial blight and grey mildew), under natural epiphytotic conditions, adopting recognized scales.

In the initial vegetative growth phase, incidence of sucking pests was observed in the first week of September, which reached the peak in the third week. The crop was protected from complete defoliation by spraying recommended dose of Endosulfan pesticide on September 30, coinciding with economic threshold level. Thereafter, continuous rains kept the incidence below threshold level. The incidence of Jassids and whitefly count was recorded from upper, middle and lower leaves of three randomly selected plants per entry; while aphid count was recorded in three plants selected at random. The bollworm damage was recorded at maturity and expressed in *percent* damage of locules.

Observations on Alternaria leaf spot (ALB), Bacterial blight (BLB) and Grey mildew (GM) were also recorded adopting standard scale/ grade

#### **Advance Introgressed Material**

**Jassids :** Incidence of Jassids ranged from 0.0-1.00 (*G.arboreum*), 0.00-0.67 (*G. herbaceum*) and 0.0 – 1.67 (*G. hirsutum*) in the introgressed advance generation derivatives with a wide distribution.

Eleven *G. arboreum*, two *G. herbaceum* and six *G. hirsutum* based entries were found to be highly resistant; among these, AKA 01-5, AKA 01-9, AKA 01-10, AKA 9136, AKDH 36, AKA 0311, RAC 023, RAC 029, LD 327, G-CA 19 (*G. arboreum*), Hh 8, Hh 13 (*G. herbaceum*) and IS-376-4/1/1, IS-376-4/1/5, IS-376-4/1/6, IS-376-4/1/7, IS-376-4/1/15, TCH 1649 (*G. hirsutum*) showed nil jassid count with I injury grade.

There was wide variation in reaction to this pest, with majority of entries of all three species based material falling in moderately resistant grade, whereas two *G. hirsutum* based entries, namely, TCH 1653 and Rai 4A-2 were highly susceptible showing injury grade IV with curling leaves symptoms.

**Aphids:** There was also wide variation in test entries for aphid count ranging from 0.0 – 0.67 (*G. arboreum*), 0.00 – 0.67 (*G. herbaceum*) and 0.0 – 4.33 (*G. hirsutum*) with majority of entries (81) falling in resistant to moderately resistant grade. Five entries, namely, AKH 0302, IS-376-4/1/4, IS-376-4/1/14, NHIS 4, GISV 238 of *G. hirsutum* and three entries, namely, Hh 5, Hh 13, Hh 16 of *G. herbaceum* base showed nil preference. Majority of *G. arboreum* based entries showed nil preference to aphid this season . *G. hirsutum* based entries TCH 1693, TCH 1695 and TCH

1652 were found to be highly susceptible, while seven entries showed moderate susceptibility.

**Whitefly:** The distribution of test entries showed that 51 derivatives belonging to gene complexes of three species showed highly resistant reaction, where as 38 and 15 entries, respectively, exhibited resistant and moderately resistant reaction. Seven *G. hirsutum* entries were, however, highly susceptible to this pest. The incidence of whitefly was high as compared to last season due to high moisture content.

On critical evaluation of advance generation progenies, it was possible to identify following promising entries possessing highly resistant score to all the three major sucking pests. These entries also showed better performance against the check entries evaluated in this study, however, RG 8 was found to be highly resistance to all the three sucking pest. This could be attributed to red pigmentation, which conferred effective resistance. The red pigmentation is governed by dominant genes and can be used as marker in distant hybridisation and varietal identification.

<i>G. arboreum</i>	AKA-01-4, AKA-01-5, AKA-01-9, AKDH 36, AKA 0312, AH-17-3, RAC – 029, RAC – 027, RAC – 032
<i>G. herbaceum</i>	Hh-5, Hh-8
<i>G. hirsutum</i>	AKH 8828, AKH 0301, AKH 0306, IH 63, Rai 11-1, MSH-SP-91, IS-376-4/1/20, 23, 24, 25, 30, and 31

#### **Segregating Introgressed Material**

Screening results of segregating diploid and tetraploid *Gossypium* materials are summarized, in brief, as under:

**Jassids:** Among the segregating diploid and tetraploid introgressed entries, jassid incidence ranged from 0.0 – 1.33 with jassid injury grade I – III. Four *G. arboreum* and one *G. hirsutum* based entries exhibited high resistance against jassids; among these, Arboreum × Barbadosense (F3), Pondurx × arboreum (F2-6), Sarvottam × KWA 7, Sarvottam × PA 405 showed nil preference. Among susceptible entries belonging to *G. hirsutum* background, Abadhita × Rai (F3), Abadhita × Surat 5 (F3), Abadhita × TCH 2 (F3), G. Cot 16 × GISV-162 was susceptible with injury grade III.

**Aphids:** Though distribution of test entries was highly variable five *G. arboreum* based entries and one *G. hirsutum* exhibited highly resistant score. Similarly, as

many as four entries of both species, showed resistant reaction. The material derived from *G. arboreum* showed almost nil susceptibility score, while ten *G. hirsutum* entries were susceptible.

**Whitefly:** Among nine *G. arboreum* based entries, only two showed highly resistant reaction. Similar performance was also exhibited by entries with genetic background of *G. hirsutum* with as many as eight showed highly resistant reaction. During the season incidence of whitefly was observed to be more due to high moisture condition.

On the basis of above, it was possible to identify entries showing resistant reaction to pest complex, these are

*G. arboreum* Sarvottam × KWA 7, Sarvottam × PA 405,

*G. hirsutum* Abadhita × MSH-SP-53, Abadhita × TCH 1, IS 376/4/2/9 × RS 875, IS 376/4/2/15 × RS 875, G. Cot 16 × GISV-61, LRA 5166 × IGM 42, IRH 1-4 SP's - 7

#### ❖ **Screening of Introgressed Gossypium derivatives against bollworm complex**

The entire materials belonging to advance generation and segregating materials of three gene complexes of *G. arboreum*, *G. herbaceum* and *G. hirsutum* were evaluated to boll worm damage in terms of locule damage (%) under natural epiphytotic conditions at the time of harvest. The bolls were also damaged due to physiological factors, as well.

It was observed that lowest locule damage (1.28 – 26.0%) was observed in *G. arboreum* population as against other two wherein the damage ranged 19.0 – 25.70 and 5.56 – 36.22% respectively. The lowest damage was in *G. arboreum* entries LD 327 followed by AKDH 33, RAC 023, AKA 0311 and AKA-01-4. In *G. hirsutum* derived population the damage, in general, was high extending up to 36.22% (IGM 100); among these 13 entries showed heavy damage ranging from 25 – 36.22%. Entries IH 63, AKH 2053, AKH 0303, AKH 0305, IGM 102, Rai 11-3, and TCH 1653, found to show low damage extending up to 10%.

In *G. herbaceum* based population, the extent of bollworm damage was slightly higher than *G. hirsutum* and could be ascribed to late maturity of the crop. The extent of damage in *G. arboreum* population was less than the other two due to escape mechanism associated with early maturity.

Among the set of segregating diploid and tetraploid introgressed *Gossypium* materials, *arboreum* × *barbadense* showed moderately low damage of 8.76%. The locule damage in *G. arboreum* based population was less than that derived from *G. hirsutum*, as was also observed in advance generation stable genotypes. Heavy damage to the extent of 31.8 % was in Pondura × *arboreum* (F2-1), and in two *G. hirsutum* entries, viz. GISV 2511699 × *G. Cot 10* (29.49%), and IS 376/4/2/15 × RS 875 (26.29). Among *G. hirsutum* entries, as many as, twenty entries of *G. hirsutum* showed moderately high to heavy damage.

### Screening of Introgressed *Gossypium* derivatives against foliar disease

Screening exercise was conducted on three commercially important foliar diseases namely, Alternaria leaf spot (ALB), Bacterial blight (BLB) and Grey Mildew (GM) and disease score of each entry is given in the Tables 1.3.5 & 6 below for both advance generation derivatives and segregating materials (diploid and tetraploid) adopting zero to four scale.

**Table 1.3.5 : Reaction to Foliar diseases observed in Diploid and Tetraploid Introgressed *Gossypium* cultivars**

Grade	<i>G. arboreum</i>			<i>G. herbaceum</i>			<i>G. hirsutum</i>		
	ALB	BLB	GM	ALB	BLB	GM	ALB	BLB	GM
<b>0</b>	1	1	9	-	-	-	-	-	19
<b>1</b>	26	25	-	-	-	5	16	17	40
<b>2</b>	2	3	20	-	5	-	43	49	23
<b>3</b>	-	-	-	5	-	-	23	16	1
<b>4</b>	-	-	-	-	-	-	1	1	-

**Table 1.3.6 : Reaction to Foliar diseases observed in Segregating Diploid and Tetraploid Introgressed cultivars of *Gossypium***

Grade	<i>G. arboreum</i>			<i>G. hirsutum</i>		
	ALB	BLB	GM	ALB	BLB	GM
<b>0</b>	1	3	9	-	-	2
<b>1</b>	6	6	-	1	1	1
<b>2</b>	2	-	-	16	16	24
<b>3</b>	-	-	-	21	15	9
<b>4</b>	-	-	-	-	6	2

**0**-Disease free; **1**-Resistant; **2**-Moderately resistant; **3**-Moderately susceptible; **4**-Susceptible

Based on overall performance, it was proposed to evaluate following materials at multilocations to verify stability in performance.

**Alternaria Blight** AKA-01-10, *arboreum* × *barbadense*

**Bacterial Blight** AKA-01-10, Ponduru × *arboreum*, *arboreum* × *barbadense*

## **Evaluation of introgressed derivatives of *Gossypium* for seed cotton yield and associated agronomic characters**

Agronomic evaluation of introgressed advance generation derivatives (114) and also early generation diploids and tetraploid (44) was undertaken by scoring the population for seed cotton yield (g/ plant and q/ha) and five associated traits, namely, monopodial and sympodial branches, boll number, boll weight (g) and plant height (cm) based on observations on three competitive plants, selected at random.

The tall plant height in six segregating *G. arboreum* and three *G. hirsutum* entries was perhaps due to hybrid vigour operating in an altered genetic make up of these early generation derivatives. Performance of all five *G. herbaceum* entries was not encouraging (13.5 – 46.2 g/plant and 1.71 – 4.47 q/ha). Similarly the performance of as many as 76 *G. hirsutum* derivatives representing 91% in set I and 33 derivatives in set II representing 87% population, respectively was not satisfactory. Majority of *G. arboreum* based derivatives, in general, gave good performance, but AKA-01-5, AKA-01-9, AKA 8, AKA 9136, AKA 0312, AH-17-3, RAC – 029, RAC – 032, RAC – 035, GCA 19, 709 exceeding the check PA 183 (102.6 g). Similarly, mean performance of IS 376/4/1/23 (136.32 g) a *G. hirsutum* derivative was better than the check NHH 44.

Among the segregating population of *G. arboreum*, two entries namely, Sarvottam × PA 405 (199.95 g), Sarvottam × DLSA – 202 (123.83 g) exceeded the check.

## **Cotton improvement by microinjection with agronomic traits (Drought resistant and defense genes)**

### **❖ Isolation and characterization of insect resistant gene (Protease inhibitor)**

Protease inhibitor genes were isolated by polymerase chain reaction (PCR) from cotton genome. To amplify the expected or targeted genes forward and reverse primers were designed on the basis of published sequences.

Plant materials: Indian elite cotton *G. hirsutum* – cultivars viz., Anjali (LRK - 516) LRA – 5166, MCU – 5, and *G. arboreum* - cultivar AKA – 8401 were used for isolation of PI genes. The intact DNA was isolated, purified and used as template DNA for targeted gene isolation.

Touch down PCR principle was used for amplification of expected DNA fragment, where the annealing temperature was reduced gradually from 64 to 50 to enrich

the target sequences (94, 64, 72 - 94, 62,72, 94, 60,72 -94, 50, 72 C ° ). The amplified product was resolved on 1.5 % agarose gel indicated that the expected fragment of the same size as full-length genes of 650 bp for Kti3 and 250 bp for PI - IV primers. The fragments were cloned into pDrive vectors (Qiagen) and transformed into host bacteria. The transformed bacterial plasmid was isolated and reamplified the cloned PI genes and the results showed the identical fragment length. The PI gene amplified with Kti3 primer was cloned into pDrive vector and it was sent for the sequence analysis to M/s. Tech Dragon Limited, Calcutta. However the sequence has to be repeated since many nucleotides had ambiguity.

❖ **Isolation and characterization of Drought resistant genes – Dehydrins:**

Dehydrin was isolated from 3 cotton cultivars viz *G. hirsutum* cultivars (LRK - 516 and MHL- 685) and *G. arboretum* cultivar (AHK-4). Specific forward and reverse primers were designed on the basis of the dehydrin gene sequences already published and available in the public domain in the Gene Bank.

Primer specific PCR amplification was carried out in EPPENDORF thermal cycler. The amplified products were resolved on 1.5 % agarose by gel electrophoresis. The bands were observed under UV-light. Bands were cut out and the DNA was eluted by electroelution technique. The DNA thus obtained was cloned into pDrive vector.

With the primer (Dhn Lea3D147), MHL – 685 (*G.hirsutum*), amplified three fragments as expected viz, 0.5, 0.4 and 0.35 kb, since dehydrin belongs to multigene family. The three fragments confirm that the presence of dehydrin genes in cotton genomes, whereas in Anjali (LRK – 516) a small gene approximately 0.2 kb was amplified at higher annealing temperature 62°C. A 0.7 kb gene was amplified in MHL – 685 at an annealing temperature of 36°C.

The plasmid was pushed into *E.coli* strain DH5α cells. Then the culture was plated into LB medium which was supplemented with IPTG, X – Gal and Kanamycin. The recombinants were then identified by blue / white colony selection principle. The non - transformed cell formed blue colonies, whereas the transformed one formed white colonies. The sequence analysis is in progress.

**NORTH ZONE:**

**RAU, Sriganaganagar:**

**Trial I: Evaluation of introgressed material received during 2004-05.**



During kharif, 2004-05, 87 genotypes received from (26 Sirsa, 13 Dharwad, 5 Rahuri, 11 Surat, 2 Hisar, 1 IARI, 27 Guntur and 2 Nanded) were evaluated for seed cotton yield, agronomic traits, resistance against insect pests and quality parameters. Depending upon the availability of seed material, these genotypes were evaluated in three sets.

**Set I:** In this set, 42 genotypes (26 received from CICR, Sirsa, 13 from UAS, Dharwar, 2 from MPKV, Rahuri and one from HAU, Hisar) were evaluated. The detail of experiment is given below;

**Agronomical Traits:**

Seed cotton yield of genotypes evaluated was varying from 123 to 3853 kg/ha with a mean of 1256 kg/ha. Genotype RS 2013 x TCH 1648 (3853 kg/ha) gave maximum seed cotton yield followed by VHF x IH 35 (2655 kg/ha) and PM x TCH 1648(2598 kg/ha). Eight genotypes received from Sirsa (BM x TCH-1648, BM x TCH-1652, VHM x TCH-1648, VHF x IH-35, PM x TCH-1648, LH-900 x IH-35, RS-2013 x TCH-1648 and RS-2013 x TCH-1652) gave more than 2000 kg/ha yield. All the genotypes received from Dharwar except one (ABADHITA x MSH-345) gave poor seed cotton yield (<500kg/ha). Similarly, strains from Rahuri and Hisar also did not perform well for seed cotton yield.

The average boll weight in the material received from Sirsa was in general more than 3g and 8 out of 13 genotypes from Dharwar were also having boll weight more than 3g. Genotype from Rahuri and Hisar were having boll weight of 2g. or less than 2g. The seed index for genotypes received from Rahuri and Hisar were poor (<5.0g). Amongst genotypes in this trial ginning outturn ranged from 33.0 (Abadhita x TCH 1) to 39.90 (Abadhita x AKH 2053) percent. Genotypes received from Sirsa were having GOT from 33.8 to 38.9 per cent.

❖ **Screening against biotic stresses:**

Out of 42 genotypes screened for CLCV disease, 23 showed resistance, 5 moderately susceptible, 13 susceptible and 1 were found highly susceptible. Amongst Dharwar material all except one (Abadhita x TCH 3) were susceptible for CLCV. Genotypes received from Rahuri and Hisar were resistant, as they appeared arboreum types.

**Screening against Sucking Pests:** During kharif 2004-05, attack of Sucking Pests in this region was moderate. Out of 42 genotypes screened, 34 tolerant, 3

moderately susceptible and 5 were found susceptible to whitefly attack. Regarding jassid infestation, out of 42 genotypes screened, 34 tolerant and 8 were found susceptible.

**Bollworm Damage:** American bollworm, *Helicoverpa armigera* (Hubn.) could not appear throughout the crop season. Spotted bollworm, *Earias insulana* (Boisd.) was regular appeared during the crop season and caused severe damage to squares and developing bolls of the cotton plants. Boll damage during the crop season ranged from 2.80 to 24 percent.

**Quality parameters:** Among these 42 genotypes, 32 genotypes were selected for good quality parameters on the basis of visual observation. The mean staple length was ranged from 23.5 (HD 446/04) to 31.1mm (RAC 031). Out of 26 genotypes received from Sirsa, eight were having staple length more than 29.0 mm. The fiber strength ranged from 17.4 (HD 446/04) to 27.2 g/tex (VHF x TCH 1653). Three genotypes received from Sirsa were having both length as well as strength fairly high (BM x TCH 1648: 30.8mm & 26.3g/tex; VHF x TCH 1653: 28.9 mm & 27.2 g/tex and VHM x TCH 1653: 29.7mm & 25.8 g/tex). These materials was having moderate to high seed cotton yield also. From quality point of view, strain RAC 031 was also good as it was having 31.1mm length and 23.7 g/tex strength.

**Set II:** Thirteen introgressed materials (11 received from GAU, Surat, one from HAU, Hisar and IARI each) were evaluated for seed cotton yield, agronomic traits, resistance against insect pests and lint quality parameters.

**Agronomic Traits :** Most of the genotypes evaluated in this set were not adapted in agro climatic condition of Sriganganagar.

❖ **Screening against biotic stresses:**

**CLCuV:** Out of 13 genotypes screened, eight showed resistance, four susceptible and one was found highly susceptible.

**Screening against sucking pests:** Out of 13 genotypes, 10 tolerant, two susceptible and one were found moderately susceptible against jassid attack. Regarding whitefly infestation, out of 13 genotypes, 7 showed tolerant, three moderately susceptible and three were found susceptible. The damage due to bollworms ranged from 2.80 to 10.14 percent.

**Quality Parameters:** There was good amount of variability for fiber length, strength and short fiber content. Interspecific F<sub>2</sub> 3 entry received from IARI New

Delhi was the best for all these three parameters (mean fiber length: 29.1mm, strength: 25.3 and short fiber content 6.5 per cent). Some of the segregants in this material were resistant to CLCV also and these were selfed. Entry GISV- 61 was also found superior than others from quality point of view.

Single plants selected from HD 453 and GISV 216 will be grown in next season. One single plant showing resistance against CLCV from IARI material was selected and it was crossed also with RS 2013.

**Set III:** In this set 32 introgressed materials (27 from Guntur, 3 from Rahuri and 2 from Nanded) were evaluated.

**Agronomic Traits :** For seed cotton yield, eight genotypes viz., RAC-23, RAC-32, PA-83 x HD-269/98F<sub>3</sub>, PA-304 x HD-269/98F<sub>3</sub>, PA-304 x PA-255F<sub>3</sub>, IGM-100 x IGM-4 (AKH-2053)F<sub>3</sub>, IGM-42 x HS-258F<sub>2</sub>, IGM-120 x WILDF<sub>2</sub> were found good, giving seed cotton yield more than 10 qts/ha .

**Screening against biotic stresses :** Most of the introgressed material evaluated in this set were resistant to CLCV disease under natural condition. Out of 26 genotypes screened, 24 showed resistance against the disease where as two were susceptible.

**Screening against Sucking Pests :** The attack of Sucking Pests was moderate. Out of 26 genotypes screened against white fly attack, 20 were found tolerant, one moderately susceptible and five susceptible. Similarly for jassids attack, out of 26 genotypes screened, fifteen were found tolerant, one moderately susceptible, seven susceptible and three were found highly susceptible.

**Bollworm Damage :** Most of the genotypes were found susceptible to the attack of spotted bollworm as boll damage during the crop season ranged from 3.46 to 20.69 percent with a mean of 9.4 per cent .

**Quality parameters:** The fiber length (mm) and strength (g/tex) ranged from 22.9 to 28.5 and 20.5 to 24.4 respectively. Entry IGM-100 x IGM-4(AKH-2053) F<sub>3</sub> was having 28.5 mm 2.5% span length coupled with 22.9 g/tex strength and 5.5 micro near value. Similarly IGM-42X HS-258F<sub>2</sub> (2.5% span length 28.3 mm and strength 23 g/ tex), F<sub>4</sub> -29 x IGM-100 (2.5% span length 25.1 mm and strength 24.4 g/ tex) and RAC-35 (2.5% span length 25.2 mm and strength 22.4 g/ tex).

Among the 26 genotypes evaluated, RAC-23, IGM-100 x IGM-4 (AKH-2053) F<sub>3</sub>, IGM-42 x HS-258F<sub>2</sub>, PA-304 x HD-269/98F<sub>3</sub> were found promising, as these

genotypes were having higher seed cotton yield, good quality parameters and resistance against CLCV. Genotypes with good quality traits and agronomic traits will be evaluated in next season for from selected desirable plants.

#### ❖ **Evaluation of introgressed material received during 2004-05**

In this set, 31 genotypes (3 received from Khandwa, 8 Akola, 7 Tamilnadu, 3 Nagpur and 3 from Ludhiana) have been evaluated for seed cotton yield, agronomic traits, resistance against insect pests and lint quality. 7 genotypes Viz., NHH-02, GISV-61, GISV-142, ABADHITA x RAI, SARVOTTAM x PA-405, SARVOTTAM x KWA-7 and SARVOTTAM x PAIG-813 were also evaluated which were received during 2003-04 from Khandwa, Surat and Nanded. Observations on agronomical traits, biotic stresses have been recorded.

**Screening against biotic stresses :** Out of 31 genotypes screened, 21 showed resistance, 1 moderately susceptible, 6 susceptible and 3 were found highly susceptible.

**Screening against Sucking Pests :** In this season, attack of sucking pests was moderate. Out of 31 genotypes screened, 14 tolerant, one moderately tolerant, six moderately susceptible and ten were found susceptible to whitefly attack. Incidence of jassids was low. Out of 31 genotypes screened, 16 tolerant, one moderately tolerant, six moderately susceptible, nine susceptible and one were found highly susceptible against jassid attack.

**Bollworm Damage:** American bollworm, *Helicoverpa armigera*, (Hubn.) was not found in the experimental plots. Spotted bollworm, *Erias insulana* (Boisd.) made regular appearance during the crop season and caused severe damage to squares and developing bolls of cotton plants. Boll damage during the crop season ranged from 6.17 to 18.75 percent.

Among the genotypes TCH-1652 (2.5% span length 27.1 mm, and strength 24 g/tex), AKH-0302 (2.5% span length 27.7 mm and strength 23.3 g/ tex), KWIS-23 (2.5% span length 31.1 mm and strength 23.2 g/ tex) and TCH-1695 (2.5% span length 29 mm and strength 23.1 g/ tex) were found promising from fiber quality point of view. Six single plants were selected for fiber quality. Out of six, four *desi* genotypes were found very promising for fiber quality. These genotypes can be used for improve the quality of our medium staple cultivated genotypes.

## **CICR, Sirsa :**

### **❖ Advancement of F<sub>2</sub> segregating generation to F<sub>3</sub> segregating generation**

Out of 33 F<sub>2</sub> progenies, 15 promising single plants were selected. The single plant selected from interspecific -F<sub>2</sub>-2-P<sub>1</sub> recorded the highest seed cotton yield (211g/plant). Highest boll number (48) was recorded in interspecific -F<sub>2</sub>-2-P<sub>2</sub>. The highest ginning out turn of 35.8% was recorded by (GISV-185 x S. dwarf) x RS 2013 (Fuzzy)-P<sub>1</sub>. 2.5 % span length was found to be maximum in (GISV-185 x S. dwarf) x RS 875-P<sub>1</sub> (29.3 mm). Uniformity Ratio ranged between 46 % (GISV-185 x S. dwarf) x RS875-P<sub>2</sub> and interspecific-F<sub>2</sub>-2-P<sub>1</sub> and 52 % (GISV-197 X GISV-61) x RS 875-P<sub>1</sub>. The highest fibre strength of 24.3 was recorded by interspecific -F<sub>2</sub>-2-P<sub>1</sub>.

### **❖ Advancement of F<sub>3</sub> segregating generation to F<sub>4</sub> segregating generation**

Out of 29 F<sub>3</sub> progenies, 21 promising single plants were selected. The single plant selected from (Abhadita x AKH2053)-P<sub>1</sub> recorded the highest seed cotton yield (234g/ plant). Highest boll number (80) was recorded in (AROGYA x CNH3919)-P<sub>1</sub>. The highest ginning out turn of 37.4 % was recorded by the single plants selected from *G. hirsutum* lines (IGM102 x NA1325)-P<sub>2</sub>, and *G. arboreum* line (PA183 x HD269/98)-P<sub>1</sub>. 2.5 % span length was found to be maximum in (F1914 x IGM102)-P<sub>1</sub> (29.1 mm). Uniformity Ratio ranged between 46 % (PA304 x HD269/98)-P<sub>2</sub>) to 54 % (PA183 x HD269/98)-P<sub>1</sub>. The highest fibre strength of 20.1 was recorded by (F1914 x IGM102)-P<sub>1</sub>.

### **❖ Advancement of F<sub>4</sub> segregating generation to F<sub>5</sub> segregating generation**

Out of 5F<sub>4</sub> progenies, 2 promising single plants were selected. The single plant selected from GISV 197 x GISV-61-P<sub>2</sub>/P<sub>2</sub> recorded the highest seed cotton yield of 186 g/plant. The highest ginning out turn of 37.0 % was recorded by GISV 197 x GISV-61-P<sub>2</sub>/P<sub>2</sub>.

### **❖ Advancement of F<sub>5</sub> segregating generation to F<sub>6</sub> segregating generation**

Out of 6 F<sub>5</sub> progenies, 20 promising single plants were selected. The single plant selected from Gcot.16 x GISV61-P<sub>2</sub>/P<sub>2</sub> recorded the highest seed cotton yield (198 g/ plant). The highest ginning out turn of 37.2 % was recorded by Gcot.16 x GISV61-P<sub>1</sub>/P<sub>1</sub>/P<sub>1</sub>. 2.5 % span length of 27.3 mm was found to be maximum in Gcot.16 x GISV61-P<sub>1</sub>/P<sub>5</sub>. Uniformity Ratio ranged between 44 % Gcot.16 x GISV61-P<sub>1</sub>/P<sub>7</sub> 54 % in Gcot.16 x GISV61-P<sub>3</sub>/P<sub>1</sub>, Gcot.16 x GISV61-P<sub>1</sub>/P<sub>3</sub>, Gcot.16

x GISV61-P1/P<sub>5</sub> and Gcot.16 x GISV61-P1/P<sub>6</sub>. The highest fibre strength of 20.8 g/tex was recorded by Gcot.16 x GISV61-P1/P<sub>1</sub>.

#### **IARI, New Delhi :**

##### **❖ Performance of fresh introgressed lines and segregating materials**

Thirty-two introgressed lines and segregating material in tetraploid *G.hirsutum* L. and diploid *G. arboreum* L. cotton background were received during 2004 from UAS Dharwar, GAU, Athwa (Surat), CRS, Nanded, Akola, MPKV, Rahuri, CICR Nagpur, CICR, Sirsa, CCSHAU, Hisar, JNKVV, Khandwa (M.P.), ARS, Sriganagar, LAM, Guntur and IARI, New Delhi.

##### **❖ Performance of segregating material received during 2004-05**

The segregating materials have been characterized with poor to moderate boll weight , acceptable GOT % and good number of boll opening (app. 100%). The segregating materials from LAM, Guntur showed compact plant type with less number of sympodia and monopodia. In case of number of monopodia per plant and total number of bolls showed high level of variability and on the other hand moderate level of variability reported in case of number of opened bolls. A low level of variability seen in case of ginning turn out, plant height, sympodia per plant and boll weight.

##### **❖ Performance of Carry-over material and segregating generation**

##### **Performance of different segregating generations F3, F4 and F5 :**

Few F3 lines showed good performance, one cross (321-2-P1 X AKH 2053) having 3.6 gm of boll weight and higher ginning outturn % (36.1) as well as Abhadita X Surat-9 P6 also showed good boll weight and higher ginning outturn. These segregating lines showed resistance for sucking pest, jassid and boll worm complex (*Heliothis* and *Erias*). In case of plant height, first fruiting node, ginning turn out and seed index low level of variability was seen. In general these lines were susceptible to CLCuV.

##### **❖ Materials developed at IARI, New Delhi grown during summer**

One heat tolerant, early maturing interspecific cross (*G.hirsutum* L X *G. barbadense* L) was identified during summer 2002 and the promising plants were selected in F2 grown in the main season 2002. Most of the progenies were uniform and showed good performance. As very low level of variability (< 5) reported in case of days to squaring, days to flowering, days to boll opening, days to 50% boll opening, ginning out turn, seed index and lint index.

**Fiber Quality Traits :** Only twelve entries showed high fiber strength g/tex  $\geq 24$ . Two entries showed 2.5% span length  $\geq 30$ . The ratio of 2.5% span length to fiber strength has also been found to be very close to 1.0 (**which is need of the modern textile industry**) in BF X TCH-1653 (F1), RS -2013 X TCH-1652, (GISV -197 X GISV-61)RS 875 P4 (25.2 fiber length and 25.3g/tex fiber strength), GISV 197 X GISV 61 x RS 2013 P2 (22.3 and 21.6) and IGM 102 X IGM 100 (21.8 and 21.6),

**Evaluation of introgressed genetic material for the trait in question and utilization in transferring to the good agronomic base adopted genotypes**

❖ **Evaluation of identified existing interspecific derivatives and new F<sub>1</sub>s for superior trait and backcrossing to the adopted genotypes**

**SOUTH ZONE :**

**CICR, COIMBATORE**

Interspecific as well as inter-racial cross derivatives available already in the station were evaluated. Several promising lines were identified for resistance to biotic stresses as exhibited by better biochemical characteristics and these lines will be utilized in breeding programmes. In a replicated station trial, superior plant progenies of inter-racial cross derivatives were evaluated for yield and other characters. Analysis of data on seed cotton yield indicated significant difference. The highest yield was recorded in the progeny ACT-SP-8-1 (16.7 q/ha) with 60,78 and 297 % increase in yield over the check varieties Sumangala, LRA 5166 and Surabhi, respectively. The progeny ACT-SP-5-2 had the biggest boll with 5.1 g/boll as compared to 3.5 to 3.8 g/boll recorded in the check varieties. This progeny also recorded the highest lint index of 7.3 g, whereas the highest seed index was recorded in the progeny ACT-SP-45-1 with 10.8 g. As high as 42 % of ginning outturn was recorded in the progeny ACT-SP-16-1, whereas in the check varieties it ranged from 31.4 to 34.3 %.

Based on morphological characters, several single plants were selected from the germplasm accessions of *G. hirsutum* during the *kharif*, 2001-02 and the selected plants were evaluated during *kharif*, 2002-03 and 2003-04 for yield and fibre quality. Based on fibre quality, select lines were advanced further for evaluation during the current season. A replicated station trial was conducted to evaluate the performance of these select lines for yield and agronomic characters. Analysis of data on seed cotton yield indicated significant difference and the maximum yield

was recorded in the germplasm line ICGH - 475 with 11.4 q/ha with 44, 105 and 172 % increase in yield over Sumangala, Surabhi and LRA 5166 respectively. The germplasm line ICGH - 477 and ICGH - 379 had the maximum boll weight of 5.1 g/boll, whereas the line ICGH - 432 had the highest lint and seed indices (6.3 and 11.4 g, respectively). The germplasm line ICGH - 379 also had recorded the highest ginning outturn.

Also, several other germplasm accessions of *G. hirsutum*, *G. barbadense* and *G. arboreum* were sown for evaluation and identification of superior lines for utilization in breeding programmes. About 330 *G. barbadense* accessions being maintained in the station were seed multiplied and maintained by selfing. When the fibre quality of *G. barbadense* germplasm accessions were evaluated for fibre quality in HVI, it was found that several accessions were found to have superior fibre quality better than that of Suvin.

The maximum boll weight (3.1 g/boll) and seed index (8.9 g) was recorded in ICB 32, whereas the maximum lint index was recorded in ICB 276 (4.9 g). For ginning outturn, the accession ICB 5 was found to be the best with 38.9%. As high as 35.2 mm of 2.5% span length was recorded in the accession ICB 220 as compared to 34.7 mm recorded in Suvin. Similarly, for uniformity ratio (49.7%) and micronaire (4.2) the accession ICB 185 was the best. The highest bundle strength of 29.8 g/tex was recorded in the accession ICB 110 as compared to 24.9 recorded in Suvin. However, for elongation the Suvin variety was found to be the best.

#### **LAM Guntur:**

The crosses ( $F_1$ ) made out of promising lines identified from the interspecific derivatives (Table 1.3.7) with locally adopted lines were studied during this season. Besides above number of crosses were made involving high strength lines I 132, I 133, I 427, I521, 2-264 and L 755 and the  $F_1$ 's were studied during the season. The highest seed cotton yield of 220 g/plant was recorded by JK 276-4 X TCH 1699 cross-followed by LK 861 X L 755 (205 g/plant) . Highest fibre length of 33.43 mm was recorded by LK 861 X TCH 1623 followed by MCU 5 X H98 (33.42 mm). For fibre strength highest value of 27.5 g/tex was recorded by LK 861 X B 5-33, followed by LK 861 X H 96 (25.49 g/tex) and L 601 X B 5-33 (25.2 g/tex).



**Table 1.3.7 :**

SN	Name of the cross	Characters of breeding value
1.	( <i>Arboreum</i> X <i>Barbadense</i> ) X LAS 2	To improve fibre quality
2.	(Sarvottam X KWA 7) X LAS 2	To improve fibre quality
3.	(Sarvottam X KWAN-4) X LAS 2	To improve fibre quality
4.	(Sarvottam X DLSA 202) X LAS 2	To improve fibre quality
5.	(Sarvottam X PA 405) X LAS 2	To improve fibre quality
6.	(PKV intro F <sub>2</sub> /9) X LAS 2	To improve fibre quality
7.	(Sarvottam X Parg8/3) X LAS 2	To improve fibre quality
8.	I S376/411/LNo. 40 X RCH 144	Tolerance to sucking pests
9.	I S376/411/LNo. 40 X RCH 2	Tolerance to sucking pests
10.	I S376/411/LNo. 40 X RCH 20	Tolerance to sucking pests
11.	(F <sub>4</sub> -16 X AKH 2053) X CWROK 165	Boll size and yield
12.	(LK 861 X AKH 2053) X CWROK 165	Boll size and yield
13.	(GISV 197 X GISV 61) X NHyps 152	Boll size and yield
14.	F <sub>4</sub> -29 X NHyps 152	Boll size and yield
15.	(Khandwa X <i>Anamolium</i> ) XIS376/411/LNo.40	Drought and sucking pest
16.	(Khandwa X <i>Raimondi</i> ) X IH 35	Drought and sucking pest
17.	(Khandwa X <i>Raimondi</i> ) X NDLH 1678	Drought and sucking pest

**UAS, Dharwad :****❖ Evaluation of stabilized *G. arboreum* lines for yield and fibre quality parameters.**

**Set I :** Nine *G. arboreum* stabilized lines developed through introgression breeding were received during 2004 from MPKV Rahuri, PDKV Akola and CICR Sirsa were evaluated along with local check DLSa-17. Among the 10 genotypes, highest seed cotton yield of 1858 kg/ha was observed in RAC-023, which also recorded maximum GOT (41.9%) and maximum boll weight. Totally 5 genotypes are numerically superior for seed cotton yield over local check DLSa-17 (1584 kg/ha). The genotypes AKA-0311 and RAC-023 recorded maximum boll weight of 3.3 g followed by AKA-0312 (3.2g). The mean GOT value was 37.2% with a range of 29.5 to 41.9%. Seed index observed was 5 to 6g in almost all genotypes.

Most of the genotypes exhibited resistant to moderately resistant type of reaction for different foliar diseases like bacterial blight, grey mildew and rust. But, for alternaria blight most of the genotypes showed moderately resistant to moderately susceptible type of reaction.

Maximum staple length was observed in RAC 032 (25.0 mm) followed by local check DLSa-17 (24.8 mm), RAC-023 (24.2mm) and RAC-031 (24.0 mm). Higher yield and fibre length was observed in most of the entries compared to local check DLSa-17 but, none of the entries had higher strength and lower micronaire value

than local check DLSA-17. The mean fibre strength was 20.1 g/t with a range of 18.5 g/t in CISA-6 to 21.0 g/t in DLSA-17 (LC).

**Set II:** Eight introgressed stabilized *G. arboreum* lines identified at Dharwad centre were evaluated along with local check DLSa-17. Among the 9 genotypes, highest seed cotton yield of 2026 kg/ha was observed in RAC-029, which also recorded maximum GOT (42.5%). Totally 5 genotypes are numerically superior over local check DLSA-17 for all yield and yield related parameters. Average boll weight was 2.9 g with a range of 2.7 g in DLSa-17 to 3.5 g in AKA-9106. The maximum GOT was observed in RAC 025 (42.8%) and minimum was observed in RAC 028 (36.3%). The average seed index was observed to be 6 g. Most of the genotypes exhibited resistant to moderately resistant type of reaction for bacterial blight, grey mildew and rust diseases, except alternaria blight.

Mean staple length observed was 25.4 mm with a range of 22.7 (RAC-028) to 28.5 mm (DLSa-17, LC). Though genotypes with high seed cotton yield potential were observed, none of the genotype was superior in fibre quality than local check DLSa-17.

❖ **Evaluation of stabilized *G. herbaceum* lines for yield and fibre quality parameter.**

Fifty stabilized *G. herbaceum* introgressed lines developed at Dharwad centre were evaluated in 3 different sets. Set-I and Set-II were evaluated at Dharwad location itself and the best performing lines were selected among these 50 lines were evaluated at Annigeri location as Set-III.

**Set-I.** Under this trial, totally 28 genotypes including Jayadhar (herbaceum check) and DLSA-17 (arboreum check) were evaluated under RBD with 2 replications. The genotype Jab-27 produced significantly higher seed cotton yield (797 kg/ha) over local check Jayadhar (537 kg/ha). The genotype Jab-2 (760 kg/ha), Jab-3 (705 kg/ha), Jab-4 (700 kg/ha) and Jab 16 (697 kg/ha) produced numerically higher seed cotton yield compared to local check DLSa-17 (694 kg/ha) and Jayadhar (537 Kg/ha). This shows that for yield potential, herbaceum genotypes have been developed through introgression breeding on par with the arboreum check which can be cultivated in the traditional herbaceum tracts with their added advantage of stress tolerance. There is no significant difference among the genotypes tested for boll weight. None of the test entries were numerically superior

for GOT over local check Jayadhar (32.5%) and DLSA-17 (34.6%). Seed index observed was 6.0g in all the entries. Most of the genotypes exhibited moderately resistant to susceptible type of reaction for alternaria blight and grey mildew but for rust, resistant to moderately resistant type of reaction was observed.

The genotype Jab-6 (25.0mm), Jab-24 (24.8 mm), Jab-1 (24.6 mm), Jab 25 (24.4mm), Jab-2 (24.2mm), Jab-3 (24.1mm), Jab-26 (24.1mm) and Jab-27 (24.0mm) recorded numerically higher staple length compare to local check Jayadhar (23.3 mm, Table 79a). The genotypes Jab-6 (20.5 g/t), Jab 24 (20.3 g/t), Jab 15 (20.2 g/t), Jab 19 (20.2g/t), Jab-14 (20.0g/t) and Jab 20 (20.0g/t) recorded numerically higher fibre strength compared to local check Jayadhar (19.1 g/t). The maximum staple length (30.7mm) and fibre strength (22.3g/t) were observed in local *arboreum* check DLSA17.

**Set- III:** Twenty-four well performing lines selected from last season were evaluated along with local check Jayadhar and DLSA-17 under RBD with 2 replications. Jab-79 (2452 kg/ha), Jab-74 (2041 kg/ha), Jab-61 (1986 kg/ha), Jab-60 (1938 kg/ha) and Jab-70 (1824kg/ha) recorded numerically higher seed cotton yield over local check Jayadhar 1593 (kg/ha) and DLSA-17 (1299 kg/ha). Average GOT observed to be 31.6% and it varied from 30.0% in Jab-62 to 34.0% in DLSa 17. Seed index mean was 6.0g.

None of the test entries produced staple length higher than local check Jayadhar (25.5mm) and DLSA 17 (27.6mm). However, the entries Jab-66 (20.4g/t), Jab-62 (20.0g/t), Jab-72 (19.8 g/t) and Jab -76 (19.8g/t) produced numerically higher fibre strength compared to local check Jayadhar (19.7 g/t).

#### **CENTRAL ZONE:**

##### **CRS, Surat:**

##### **❖ Study of BC<sub>1</sub>F<sub>1</sub> crosses for further evaluation.**

The trial consisted of eleven (BC<sub>1</sub>F<sub>1</sub>), six parents and a check (G.Cot-23). The materials were evaluated at Surat in single plot. The maximum seed cotton yield was recorded by (G.Cot-11 x DLSA-17) x DLSA-17 (1106 Kg/ha) followed by (G.Cot-17 x AH-32-3) x AH-32-3 (949 Kg/ha). The top yielding genotype maintained their superiority in lint yield also. The GOT values of these genotype ranged from 30.9 (Digvijay x Hh-1) x Hh-1 to 38.2% (G.Cot-17 x AH-36-1) x AH-36-1. The individual plants were selected for further study.

❖ **Study of F1 generation in diploid cotton developed using introgressed material (Set I).**

Twenty eight hybrids were evaluated including their parents and G.Cot DH-9 as check at Surat for improvement in yield and resistance to biotic stress. ANOVA revealed highly significant varietal differences for seed cotton yield. Only one hybrid viz., G.Cot. 23 x AH-32-3 (2949 kg/ha) appeared significantly superior over check G.Cot.DH-9(2231 Kg/ha). The top yielding hybrid maintained its rank in lint yield (1064 kg/ha) also. The GOT values of these genotypes ranged from 34.1 {G.Cot-17 x (Ponduru x *G.arbo*)} to 40.1% (G.Cot-17 x AKA-01-4). The top yielding hybrid G.Cot-23 x AH-32-3 also possessed significant positive heterobeltiosis (123.73\*\*) having of good x average combining parents and non significant positive sca effect (0.176) could proved to be very useful to isolate true breeding transgressive segregants by employing simple selection scheme since as it was supposed to be the cross in which additive variation was operative for seed cotton yield. The individual plants were selected on the basis of earliness, plant type, boll weight, number of bolls per plant, boll opening, seed cotton yield and resistance against boll worm for further study. All the hybrids found free from BLB.

❖ **Study of F1 generation developed by using interspecific derivatives and *G.barbadense* cotton. (Set-II)**

In all, eighteen hybrids developed through L x T mating design using interspecific derivatives and *G.barbadense* cotton for improvement of fibre quality in interspecific cross derivatives. All these hybrids were evaluated along with their parents and G.Cot.Hy-10 as check in randomized block design. ANOVA revealed significant varietal differences for seed cotton yield. None of the hybrids significantly surpassed to the check G.Cot.Hy-10 (1629 kg/ha) in seed cotton yield. Maximum seed cotton yield (1888 kg/ha) was recorded by GISV-203 x GISV-178 followed by GISV-203 X GISV-197 (1509 kg/ha). The top yielding hybrid maintained its superiority in lint yield (683 kg/ha) also. The GOT values of these hybrids ranged from 28.0 (GISV-203 x GSB-6) to 37.4% (GISV-201 x GISV-178). The heterosis was ranged from -54.39 (GISV-203 x GSB-7) to 25.73% (GISV-203 x GISV-178). The top yielding hybrid GISV-203 x GISV-178 had positive heterosis accompanied by positive sca effects for seed cotton yield which was derived from A

x G combining parents for seed cotton yield. The individual plants were selected on the basis of yield potential and fibre quality parameters.

❖ **Study of F1 generation developed using interspecific derivatives, exotic and *G.hirsutum* cotton (Set-III) :**

In this trial, 18 hybrids, nine parents and a check G.Cot. Hy-10 were evaluated in RBD design for improvement in yield, resistance against biotic stress and good fibre quality in interspecific cross derivatives. ANOVA revealed significant varietal differences for seed cotton yield. Seven hybrids viz., GISV-201 x TCH-1653(2164 kg/ha), GISV-203 x NH-194(2125 kg/ha), GISV-201 x TCH-1648(2041 kg/ha) GISV-61 x TCH-1653(1990 kg/ha), GISV-201 x BWR-25(1953 kg/ha), GISV-203 x TCH-1648(1909 kg/ha) and GISV-203 x TCH-1653(1872 kg/ha) appeared significantly superior over check G.Cot. Hy-10 (1349 kg/ha). The top yielding hybrid also stood first in lint yield (785 kg/ha). The GOT values of these hybrids ranged from 31.7 (GISV-201 x TCH-1648) to 39.4% (GISV-201 x NH-194). The two hybrids, viz., GISV-201 x TCH-1653 (96.02) and GISV-201 x TCH-1648 (84.91) possessed significant positive heterosis with positive sca effect which were derived from A x A combiner parents for seed cotton yield. It can be considered promising for the commercial exploitation of heterosis. The individual plants were selected on the basis of qualitative and quantitative characters for further study.

**Crossing Programme**

The crossing programme was taken during 2004-05 in two sets. One set was prepared with an object to produce high yielding hybrids with resistance against boll worm and sucking pests in tetraploid cotton. The potential parents of released hybrids, viz., G.Cot-10, G.Cot-16, BC-68-2 and G.Cot-100 were used as female parents and the male parents viz., GISV-142, NHIS-6, Stonville-20, SH-131 and GISV-206 were tolerant to boll worm and sucking pests. The seeds of following crosses were harvested and will be evaluated in next season.

<b>Female/Male</b>	<b>GISV-142</b>	<b>NHIS-6</b>	<b>Stonville-20</b>	<b>SH-131</b>	<b>GISV-206</b>
G.Cot-10	*	*	*	*	*
G.Cot-16	*	*	*	*	*
BC-68-2	*	*	*	*	*
G.Cot-100	*	*	*	*	*

\* Indicate cross bolls were harvested.

The crossed seeds of second set were produced using promising introgressed material of desi cotton for improvement in yield fibre quality and resistance against biotic stress. The released varieties viz., Sanjay, G.Cot-21 and G.Cot-23 were used as female parents, and promising introgressed materials viz., AH-10-3, DLSA-17, AH-36-1, AH-32-3, Hh-1 and RAC-024 were use as male parents. The seeds of following crosses were harvested and will be evaluated in next season.

<b>Male/ female</b>	<b>AH-10-3</b>	<b>DLSA-17</b>	<b>AH-36-1</b>	<b>AH-32-3</b>	<b>Hh-1</b>	<b>RAC-024</b>
Sanjay	*	*	*	*	*	*
G.Cot-21	*	*	*	*	*	*
G.Cot-23	*	*	*	*	*	*

#### **OUAT, Bhawanipatna:**

Based on morphological features and manual fibre quality analysis 9 lines were selected and crossed with 8 promising adoptable entries for transferring yield, high fibre length & strength, ginning outturn, boll size, disease resistance and pest tolerance. The crossed materials were harvested and kept for evaluating in the ensuing *Kharif* season.

#### **PDKV, Akola:**

Under this activity 288 genotypes derived from a synthetic allopolyploid *G.another* (F<sub>5</sub> Seg. Popl.) were grown to evaluate yield performance and fibre traits. Top ranking 20 genotypes with yield and ginning percent is given in below Table. The yield per plant ranges from 23.4 gm/plant to 15.3 gm/plant and GOT ranges from 44.3% to 30.0 %.

#### **CICR, Nagapur:**

##### **❖ Evaluation of transgressed derivatives of *G. hirsutum* in F<sub>1</sub>, F<sub>2</sub> and F<sub>3</sub> generations**

Five introgressed advance generation progenies were crossed with three parents/ hybrids belonging to *G. hirsutum* and F<sub>1</sub>, F<sub>2</sub> and F<sub>3</sub> seeds were sown in rod row unreplicated trail to evaluate the performance of F<sub>1</sub>, F<sub>2</sub> and F<sub>3</sub> generations with respect to monopodial and sympodial branch number, boll number and weight and seed cotton yield/ plant (g). The inter and intra row spacing was 60 ×60 cm maintaining plant stand of 10 and 20 plants respectively, in F<sub>1</sub>, F<sub>2</sub> and F<sub>3</sub> generations.

Monopodial branch number gradually decreased in F<sub>3</sub> generation though sympodial number that decreased in F<sub>2</sub> generation was at par with F<sub>1</sub> generation in F<sub>3</sub> generation. There was corresponding increase in boll number but did not exceed first filial generation. Both boll weight (g) and seed cotton yield/plant (g) in F<sub>3</sub> generations was at par with F<sub>1</sub>, which also exceeded the mean of F<sub>2</sub> generations, showing heterotic genetic mechanism operating in transgressed derivatives of *G. hirsutum* and offer scope for commercial exploitation of hybrid vigour in tetraploid cotton.

❖ **Evaluation of transgressed derivatives of *G. hirsutum* in F<sub>1</sub> and F<sub>2</sub> generations**

Eight introgressed advance generation progenies were crossed with six parents/hybrids belonging to *G. hirsutum* and the performance of F<sub>1</sub> and F<sub>2</sub> generations were evaluated with respect to monopodial and sympodial branch number, boll number and weight and seed cotton yield/ plant (g).

Monopodial branch number was at par in both generations though sympodial number decreased in F<sub>2</sub>; there was no corresponding increase in boll number and seed cotton yield/plant (g), except in two crosses.

❖ **Evaluation of F<sub>1</sub> hybrids belonging to introgressed derivatives and cultivars of *G. hirsutum***

In crop season 2003-04, as many as 120 crosses were attempted involving introgressed derivatives as female and cultivars/ hybrids of *G. hirsutum* as male. The hybrid seeds of all cross combinations were sown in single row plot of 6m length in rainy season 2004-05. Among these, only 25 F<sub>1</sub> hybrids appeared promising based on germination, initial plant growth, plant type and other morpho-agronomic characters including fiber quality.

Single plant observation for monopodial and sympodial branch number, boll number and seed cotton yield indicated significant variation but only a few crosses exceeded the general mean. Among these F<sub>1</sub> hybrids, viz, AKA-01-3 × DLSA 17, AKA-01-9 × DLSA 17, [Pondurx × arboreum (F<sub>2-1</sub>)] × DLSA 17, RAC – 025 × DLSA 17, 8-6 P<sub>12×56</sub> × Suvin, IS-376-4/2-Line No-16 × Rai 5A SP-5, IS-376-4/3 × G. Cot 10, TCH 1649 × Bunny, TCH 1649 × G. Cot 100, TCH 1692 × Bt supported higher number of bolls (12 – 74) with high seed cotton yield. These five hybrids exhibited heterosis for two yield traits.

**NORTH ZONE:****RAU, Sriganganagar :**

During 2003, between introgressed material from Nanded and local variety RS-875, were backcrossed with RS-875 with the objective to increase boll weight, quality and resistant against biotic factor. These backcrosses were raised during 2004-05 to multiply and segregating population will be evaluated during 2005-06.

**CICR, Sirsa :**

46 crosses attempted between local adapted cultivars and Introgressed lines were evaluated in three replications against two local check hybrids viz. Om Shankar and LHH-144. Only one cross combination RS 2013 X TCH 1652 (2161 kg/ha) recorded significantly higher seed cotton yield over both the local check hybrids viz., Om Shankar (2006 kg/ha) and LHH 144 (1728 kg/ha), whereas six crosses namely BF x TCH 1648, BF x TCH 1652, RS 2013 x TCH 1648, RS 2013 x Rai 4A, LRA 5166 x TCH 1653 and H 1098 x Rai 4A recorded higher seed cotton yield over local check LHH 144 (1728 kg/ha).

The highest ginning out turn of 35.3 % was recorded by the crosses LH 900 x IH 35 and RS 2013 x TCH 1652 followed by 35.1% in cross VHM x TCH 1648 and H 1098 x Rai A-2. The 2.5 % span length was found to be highest in cross combination BM x TCH 1653 (33.3 mm) followed by PF x TCH 1648 (30.8 mm). The uniformity ratio ranged between 44 per cent (BM x TCH 1648) to 54 per cent (PM x TCH 1652). The highest fibre strength of 25.6 was recorded by BM x TCH 1652 followed by 25.4 in cross PF x TCH 1648. Out of these 46 crosses the 15 crosses showed fibre strength more than 24.0 g/tex.

For Jassid and whitefly reaction all the hybrids were found to be tolerant. For bollworm only one hybrid i.e. BF x TCH 1653 was found resistant and 17 hybrids were found tolerant. For CLCuV reaction all the hybrids except four hybrids (VHM x IH-35, LH 900 x TCH 1648, H 1098 x IH-35 and BF x IH-35) were found tolerant.

**Evaluation of identified existing interspecific derivatives and new F<sub>1</sub>s for superior trait and backcrossing to the adopted genotypes.**

In this trial 15 crosses attempted between local adapted cultivars and Introgressed lines were evaluated against local check hybrid Om Shankar in



unreplicated plots due to small quantity of seed. Highest seed cotton yield of 2037 Kg/ha was recorded by three hybrids namely CNH 911 x TCH 1652, RS 810 x Rai 4A and F 505 x TCH1653.

The highest ginning out turn of 39.0 % was recorded by CISV-1 x TCH 1653 followed by 37.4 % in F 505 x TCH 1653. The 2.5 % span length was found to be maximum in CISV-1 x TCH1648 (29.4 mm). Uniformity Ratio ranged between 41 % (CISV-1 x TCH1648) to 50 % (RS810 x Rai7BSP<sub>12</sub>). The highest fibre strength of 24.4 (g/tex) was recorded by cross LH 900 x TCH 1652. Out of 15 cross combinations studied, five crosses showed fibre strength more than 24.0 g/tex.

For Jassid and whitefly reaction, all the hybrids were found to be tolerant. For bollworm only two hybrids i.e. CNH 911 x Rai 4A-2 and RS 810 x Rai11-3 were found to be tolerant. For CLCV reaction all the hybrids except three (LH 900 x TCH 1652, CISV-1 x TCH 1648 and F 505 x TCH 1653) were found resistant.